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# World Journal of Management Science



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# DIGITAL TRANSFORMATION AND PATENT CITATION: BASED ON THE PERSPECTIVE OF CO-DIRECTOR

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**Abstract:** Will the information of digital transformation diffuse upstream through the supply chain to promote technological spillover and corporate learning and innovation? This study selects data of the A-share listed corporates in China from 2008 to 2020 of the top five customer and supplier relationships of listed corporates. Through text analysis methods, the level of corporate digital transformation is depicted to examine the impact mechanism of customer corporates' digital-driven upstream corporate learning and innovation. The research reveals that the digital transformation of customer corporates has a promoting effect on the patent citations of supplier corporates. At the same time, when there is a connection between customer and supplier corporates through common directors, the impact of customer corporate digital transformation on supplier corporate patent citations is more significant. Further research finds that when the supplier corporate has higher total factor productivity and a greater number of highly educated talents, the impact of customer corporate digital transformation on supplier corporate patent citations is more pronounced. This study provides micro-level evidence for exploring the diffusion effects of supply chain information and corporate digital transformation, offering important insights for the innovation and development of corporates.

**Keyword:** Digital transformation; Supply chain; Patent citation

## 1 INTRODUCTION

Currently, the Chinese economy is facing a serious structural imbalance between supply and demand, with the primary contradiction hindering economic development concentrated on the supply side. The 20th National Congress of the Communist Party of China's proposal points out that China's economy has transitioned from a high-speed development stage to a high-quality development stage. To address the current issues of unbalanced and insufficient economic and social development, there is a need for supply-side reform. Supply-side reform aims to further liberate and develop social productivity, promote structural adjustment through reform, reduce ineffective and inefficient supply, and expand effective and high-end supply. With the development of the times, fields centered around digital technologies such as cloud computing, big data, artificial intelligence, and ICT are continuously maturing, driving the development of the digital economy and attracting attention. The "White Paper on the Development of China's Digital Economy (2020)" indicates that the digital economy takes digitized knowledge and information as key production factors, with digital technology as the core driving force. It achieves deep integration with the real economy through digital technology, enhances the digitalization, networking, and intelligence level of the economic and social aspects, and accelerates the emergence of new economic forms in the restructuring of economic development and governance models. The development of the digital economy brings opportunities for businesses. The "14th Five-Year Plan for the Development of the Digital Economy" provides detailed deployment to further promote the healthy development of China's digital economy. It focuses on optimizing and upgrading digital infrastructure, leveraging the role of data elements, advancing industrial digital transformation, promoting digital industrialization, and improving the governance system of the digital economy.

In the trend of corporate digital development, whether the digital transformation of customer corporates can promote

supplier corporates' citation of patents and whether corporate digital transformation can facilitate high-quality economic development have become focal points in the academic community. In the era of continuous integration of the digital economy and industrial transformation, the digital transformation of customer corporates is undoubtedly a wise move in keeping with the times. Research on whether the digital transformation of customer corporates can promote the patent citations of supplier corporates, alleviating issues such as low supply chain efficiency and insufficient corporate innovation capacity, holds practical guidance significance and socioeconomic value.

This research based on third person perspective, With the premise of the "information spillover effect" existing in the supply chain, text analysis techniques are employed to position and identify key terms related to digital transformation. The frequency of these terms is then utilized as an index to construct indicators for corporate digital transformation [1]. Through Python, annual reports of A-share listed corporates were collected and organized from major financial data websites. Jieba's segmentation and counting functionalities were employed to conduct text analysis on each listed company's annual report. This process was aimed at identifying indicators of corporate digital transformation, defining them as variable X. Referring to Aguilera-Caracuel et al. research, proactive patent citations were utilized to characterize corporate learning [2]. Due to the truncation characteristics of patent citation data, this study employed the logarithm of the number of patents cited by a company per patent application as the count of patents applied by the corporate, defining it as variable Y. By researching under the moderating effect of common directors, the benefits of digital transformation on the mechanism of corporate patent citations change. Further analysis examined whether the total factor productivity and highly educated talent of supplier corporates significantly impacted this mechanism, leading to conclusive findings. The study investigated whether the digital transformation of customer corporates could affect the production behavior and decision-making of supplier corporates through the information spillover effect in the supply chain. Positive benefits were expected in terms of information acquisition, technological innovation, and other aspects, thereby promoting their citations of patents. Heterogeneity analysis and robustness testing were conducted to further explore whether the digital transformation of customer corporates had an impact on the patent citations of supplier corporates when there were common directors between upstream and downstream corporates. This research provides empirical references for exploring whether supply chain information diffusion is influenced by corporate digital transformation and for promoting innovation and development in supplier corporates.

The marginal contributions of this paper are as follows: ①This study offers micro-level evidence, exploring the effects of supply chain information diffusion and corporate digital transformation. It enriches the economic consequences of digital transformation, providing a reference basis for promoting high-quality economic development. ②Against the backdrop of the era of corporate digital transformation, this paper innovatively enhances the literature on corporate digital transformation by starting from the impact of customer corporate digital transformation on supplier corporates. ③This paper provides data support for subsequent research on upstream corporate patent citations. In-depth analysis of these data can yield insights into technological development trends, research and development dynamics of competitors, and potential market demands. This information holds significant reference value for the product development and strategic planning of upstream corporates.

## **2 THEORETICAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT**

### **2.1 Theoretical Framework**

#### **2.1.1 Corporate digital transformation**

As corporate digital transformation gradually advances, it assumes an increasingly critical role in business activities [3]. Many scholars have explored the economic consequences of corporate digital transformation, examining it from an empowering perspective. Digital technologies facilitate high-quality development, promote the specialization of corporate division of labor, further enhance overall factor productivity, and reduce costs and inputs in the production process [4]. From an enabling standpoint, the introduction of digital technologies can bring about information spillover effects in the supply chain. When customer corporates within the supply chain undergo digital transformation, significant information spillover effects can be generated for supplier corporates, further influencing their strategic



decision-making behaviors [5]. This also aids corporates in filtering and analyzing vast amounts of data, reducing information asymmetry between corporates and investors. From an internal perspective, the efficiency of internal information transmission and communication within corporates can be substantially improved through the digital transformation of corporate information systems.

### **2.1.2 Corporate patent citation**

In order to promote high-quality development and contribute to the construction of an innovative nation, we continually explore factors driving corporate innovation. As knowledge flow and technological innovation are further reflections of patent activities, the greater the number of patents a company applies for, the broader and stronger its innovative knowledge scope and capabilities. Corporates with strong innovation capabilities exhibit higher driving forces for digital transformation. Therefore, this paper referred Boly et al. method which use proactive patent citations as an indicator of corporate innovation learning [6]. After analyzing data from 29 national-level corporate studies, corporate governance was the driving force of technological innovation, and information transparency are highly correlated. However, this research primarily focuses on foreign corporates. Further analyses by Chinese scholars reveals that supply chain information transparency indeed promotes innovation in Chinese corporates. The main promoting effect is through alleviating innovation financing constraints rather than through governance or other means. It is evident that alleviating innovation financing constraints is the primary channel through which information transparency promotes innovation [7]. Corporate digital transformation not only enhances its driving force for innovation but also significantly improves innovation efficiency, with this effect being more pronounced in state-owned corporates [8].

In summary, current researches on corporate digital transformation mostly focus on the internal aspects of corporates, with limited studies combining digital transformation with upstream and downstream corporates. The quality of information obtained by service provider corporates from customer corporates is inseparable from their business decision-making behaviors. However, existing research often overlooks the economic consequences brought about by the digital transformation of customer corporates. Furthermore, although scholars have explored related issues from various perspectives and achieved certain results, most studies focus on the quantity and efficiency of innovation brought about by corporate digital transformation, neglecting further examination of the impact of the digital economic development of customer corporates on the introduction of technology in upstream corporates. Given this, the paper aims to expand the understanding of the economic consequences of digital transformation for both upstream and downstream corporates in the supply chain, with the goal of driving economic high-quality development and fostering coordinated corporate efforts.

## **2.2 Hypothesis Development**

The widespread application of digital technology has significantly enhanced the information transparency of the supply chain. As digital technology continues to advance, an increasing number of scholars recognize that corporate digital transformation is an inevitable requirement for future economic growth. Most theoretical perspectives posit that digital technology can bring economic benefits to corporates, exerting an indispensable impact on their innovation and overall factor productivity [9]. It helps corporates gain a significant advantage in market competition. Moreover, existing research indicates that the digital transformation of customer corporates contributes to mitigating the "bullwhip effect" in the supply chain, thereby significantly improving information transparency and enhancing the information environment among supply chain partners [10]. Against the backdrop of rapid digital technology development, the timely analysis of big data in production and operations through digital platforms and real-time data analysis tools enhances decision-making quality. This improvement in information transparency not only aids in reducing information transmission delays and errors but also strengthens communication and collaboration among partners, thus improving the efficiency and flexibility of the supply chain.

Corporate digital transformation is a crucial driver for promoting innovative development and facilitating high-quality growth, contributing to the sustainability of society. Whether a modern corporate falls into the category of high-tech corporates often depends on whether its products have reached modern levels. The key to achieving product

modernization lies in the application of advanced digital technology in the manufacturing process. Digital transformation not only makes it more likely for corporates to achieve product modernization but also reduces transaction costs for businesses. According to data released by the Chinese National Bureau of Statistics, in 2023, over 80% of transactions occurred on online platforms, significantly reducing search, transportation, and inspection costs. Moreover, digital management virtually eliminates the marginal cost of corporate assets, facilitating large-scale replication and dissemination. In addition, corporate digital transformation promotes better communication with customers, enables the provision of personalized services to different users, accurately identifies customer needs, and innovates resource allocation patterns. The digital transformation of customer corporates not only benefits their own high-quality development but also inevitably influences upstream corporates. The application of digital technology provides robust support for the long-term development of corporates and makes a significant contribution to the sustainable development of society.

Based on the above analysis, this paper will propose the following hypothesis:

H1: Keeping other conditions unchanged, digital transformation of customer corporates have positive effect on patent citation of supplier corporates.

### 3 METHODOLOGICAL DESIGN

#### 3.1 Sample Selection and Data Source

This paper selects data of the A-share listed corporates in China from 2008 to 2020 of the top five customer and supplier relationships of listed corporates as the initial research sample. The financial data of the listed corporates and patent application data utilized in this study were sourced from the CSMAR database. The textual information from management analysis and discussion in the text analysis was obtained from the China National Research Data Service Platform (CNRDS). In instances where text data was missing, supplementation was performed by consulting annual report disclosure information on the SSE and SZSE's websites, and the following data are excluded: (1) exclude corporates with industry code J (financial industry) (2) exclude corporates' data that are ST or ST\*. In order to mitigate the impact of extreme values, all variable data mentioned above underwent winsorization at the 1% and 99% percentiles. Ultimately, a total of 2,215 observations were obtained for analysis

#### 3.2 Variable Definition

##### 3.2.1 Explanatory variable: *Customer corporate digital*

Currently, there is no unified indicator to measure the extent of customer corporate digital transformation. Literatures have employed various methods when exploring the measurement of corporate digital transformation. Some studies utilize sub-item metrics of macro or industry-level digital economic indices, while others attempt to use survey data from corporates. In surveys, researchers may set specific indicators such as digital systems, digital software, and the prevalence of digitization to better capture the overall picture of corporate digital transformation. However, there is still a lack of a universally applicable and comprehensive metric standard that adequately reflects the degree of corporate digital transformation.

This paper addresses this gap by utilizing text analysis techniques to locate and identify key terms related to digital transformation, using word frequency as the basis for constructing indicators of corporate digital transformation. Through Python, annual reports of A-share listed corporates were collected and organized from major financial data websites. Jieba's segmentation and counting functionalities were employed to conduct text analysis on each listed company's annual report.

##### 3.2.2 Explained Variable: *Supplier corporate patent citation (InPtnCiting)*

The duration of the same supply chain's existence (SC\_Duration) is considered as an indicator of measuring corporate learning. This study employs proactive patent citations by corporates to describe the learning situation of corporates. This choice is based on the notion that a company's patent activities represent the process of knowledge flow and learning. The more patents a company cites when applying for a patent, the broader the scope of learning from other

innovative knowledge, indicating a stronger learning ability. Corporates with robust learning capabilities also tend to have stronger driving forces for digital transformation. Given the truncation characteristics of patent citation data, this study utilizes the logarithm of the number of patents cited by a company per patent application from other organizations (InPtnCiting) as another control variable for measuring corporate learning.

**3.2.3 Other variable**

To validate the hypothesis, this study controlled for company size (Size), debt ratio (Lev), return on equity (ROE), revenue growth capability (Growth), cash flow ratio (Cashflow), years of listing (Listage), research and development expenditure (RD), and industry competitiveness (HHI).

**3.2.4 Model construction**

To assess the impact of customer corporate digital transformation on supplier corporate patent citations, the following regression model was constructed in this study:

$$\text{InPtnCiting}_{i,t} = \alpha + \beta \text{Digital}_{i,t} + \text{Control}_{i,t} + \text{Industry}_i + \text{Year}_t + \varepsilon_{i,t}$$

The dependent variable is supplier corporate patent citations (InPtnCiting), and the independent variable is customer corporate digital transformation (Digital). Additionally, industry and year dummy variables were included in the regression analysis to control for industry fixed effects (Industry) and time fixed effects (Year).

**4 EMPIRICAL RESULTS**

**4.1 Correlation Analysis**

Correlation testing assesses whether there is a relationship between variables, indicating the degree of closeness between them. By employing Pearson correlation coefficient analysis, it was found that the correlation coefficient between corporate digital transformation and corporate patent citations is 0.119, and it is significant at the 1% level. This suggests that digital transformation has a promoting effect on corporate patent citations, providing preliminary validation for the hypothesis.

**Table 1.** Correlation analysis

lnP~g	L1 D~l c	L1 CoD~r	Size	Lev	ROE	Growth	
lnPtnCi~g	1						
Digital c	0.119***	1					
CoDiretor	0.051**	0.0220	1				
Size	0.432***	-0.093***	0.0140	1			
Lev	0.134***	-0.107***	-0.00900	0.373***	1		
ROE	0.148***	0.0280	0.044**	0.118***	-0.223***	1	
Growth	0.043**	0.046**	0.0240	-0.00300	0.0120	0.292***	1
Cashflow	0.0300	-0.039*	0.0130	0.148***	-0.104***	0.295***	-0.0300
Listage	0.00600	-0.050**	0.059***	0.301***	0.436***	0.00200	-0.083***
RD	0.362***	0.136***	-0.0290	0.088***	0.0300	0.0140	-0.0320
HHI	0.0260	-0.129***	0.044**	0.333***	0.064***	0.0130	-0.053**
Cashflow	Listage	RD	HHI				
Cashflow	1						
Listage	0.157***	1					
RD	-0.038*	-0.106***	1				
HHI	0.125***	0.0280	-0.186***	1			

**4.2 Descriptive Statistics**

According to the descriptive statistics in Table 1, the mean of supplier corporate patent citations is 3.32, with a standard deviation of 2.32. The mean of customer corporate digital transformation is 0.59, with a standard deviation of 0.93. Additionally, the mean of common directors is 0.12, with a standard deviation of 0.50. This suggests that supplier corporates, in assessing their innovation status, exhibit a lack of impetus in patent citations, and the differences among peers are not substantial.

**Table 2.** Descriptive statistics

	count	mean	sd	min	p50	max
lnPtnCiting	2215	3.3201	2.3202	0.0000	3.6109	10.4436
Digital_c	2215	0.5911	0.9306	0.0000	0.0000	3.5553
CoDirector	2215	0.1151	0.5055	0.0000	0.0000	4.0000
Size	2215	22.5407	1.4598	19.7396	22.3723	27.8520
Lev	2215	0.4583	0.2088	0.0000	0.4690	0.9246
ROE	2215	0.0554	0.1197	-0.5269	0.0653	0.3138
Growth	2215	0.1336	0.3404	-0.5625	0.0978	2.3429
Cashflow	2215	0.0460	0.0631	-0.1872	0.0447	0.2542
Listage	2215	2.2634	0.7429	0.0000	2.3979	3.3322
RD	2215	14.9248	6.9696	0.0000	17.5738	23.8553
HHI	2215	0.0991	0.1189	0.0000	0.0638	1.0000

### 4.3 Baseline Results

Table 1 presents the results of the baseline regression. Columns (1), (2), and (3) all represent the regression outcomes of the impact of customer corporate digital transformation on supplier corporate patent citations. Based on the regression results in columns (1), (2), and (3), the parameter estimates for the regression coefficient of lnPtnCiting with respect to Digital are 0.1841, 0.1834, and 0.1539, respectively, all significant at the 1% level. This indicates that customer corporate digital transformation reduces transaction costs among corporates, promotes patent citations by supplier corporates, and facilitates high-quality development. This provides preliminary validation for the hypothesis that customer corporate digital transformation promotes patent applications by supplier corporates. Furthermore, the regression results in columns (2) and (3) also suggest that the effect becomes more pronounced when there are common directors between customer and supplier corporates.

**Table 3.** Baseline Results.

	(1)	(2)	(3)
	r1	r2	r3
VARIABLES	L1_lnPtnCiting	L1_lnPtnCiting	L1_lnPtnCiting
Digital_c	0.1841*** (0.0417)	0.1834*** (0.0416)	0.1539*** (0.0424)
CoDirector		0.1824** (0.0728)	0.0032 (0.0889)
Digital_c*CoDirector			0.2679*** (0.0767)
Size	0.8739*** (0.0330)	0.8720*** (0.0330)	0.8739*** (0.0329)
Lev	-0.6267***	-0.5900**	-0.5849**

	(0.2365)	(0.2367)	(0.2361)
ROE	1.0861***	1.0833***	1.0980***
	(0.3679)	(0.3674)	(0.3665)
Growth	0.0130	0.0088	0.0193
	(0.1168)	(0.1166)	(0.1164)
Cashflow	0.2221	0.2091	0.2061
	(0.6395)	(0.6388)	(0.6372)
Listage	-0.0210	-0.0339	-0.0379
	(0.0613)	(0.0615)	(0.0613)
RD	0.0592***	0.0591***	0.0586***
	(0.0068)	(0.0068)	(0.0068)
HHI	-0.4448	-0.4816	-0.4781
	(0.4059)	(0.4057)	(0.4046)
Industry FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Constant	-20.0275***	-19.9528***	-19.9585***
	(2.2074)	(2.2050)	(2.1993)
Observations	2,215	2,215	2,215
R-squared	0.4764	0.4779	0.4808
F	50.74	49.75	49.08

#### 4.4 Robustness Test

##### 4.4.1 Change the explanatory variable measure method

During the process of customer corporate digital transformation, the degree of management attention can be quantified by specific indicators, namely the proportion of the word frequency of digital transformation keywords to the total word frequency in management analysis and discussion, and the proportion of the sentence frequency of digital transformation keywords to the total sentence frequency. This study employs these two indicators as measurement metrics for the variable of corporate digital transformation. The regression results in rows (1) and (2) of Table 2 indicate that, even after replacing the measurement methods for explanatory variables, the regression results remain significant at the 1% level, consistent with the hypothesis stated earlier.

**Table 4.** Change the explanatory variable measure method

VARIABLES	(1)	(2)
	r1	r2
	L1_InPtnCiting	L1_InPtnCiting
Digital_wrds_c	338.3700*** (55.6359)	
Digital_sentence_c		5.6829*** (1.0131)
Lev	-0.6051**	-0.6066**

	(0.2355)	(0.2359)
ROE	1.0466***	1.0655***
	(0.3665)	(0.3669)
Growth	0.0165	0.0143
	(0.1163)	(0.1164)
Cashflow	0.2299	0.2359
	(0.6370)	(0.6378)
Listage	-0.0204	-0.0226
	(0.0611)	(0.0611)
RD	0.0580***	0.0583***
	(0.0068)	(0.0068)
HHI	-0.4275	-0.4255
	(0.4043)	(0.4048)
Industry FE	Yes	Yes
Year FE	Yes	Yes
Constant	-19.9118***	-20.0037***
	(2.1975)	(2.2007)
Observations	2,215	2,215
R-squared	0.4805	0.4792
F	51.58	51.32

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

#### 4.4.2 PSM

Selecting the same control variables as in the previous text, we utilized the principle of PSM (Propensity Score Matching) for sample matching and removed unsuccessful sample content. The results of the PSM test are presented in the table, where the coefficient for ESG\_C is 0.0689 and significant at the 5% level, indicating that the hypothesis remains significant.

**Table 5.** PSM

	(1)
	SCT_Num
ESG_C	0.0689**
	(2.2668)
Size	-0.7373***
	(-4.9204)
Lev	-0.2551
	(-0.2725)
ROE	-1.3476
	(-0.9478)
Growth	-0.0757
	(-0.1598)

Cashflow	-3.4782 (-1.3390)
Listage	0.3994* (1.6846)
RD	0.0355 (1.3781)
HHI	1.1057 (0.6981)
Industry FE	Yes
Year FE	Yes
_cons	12.0642* (1.9130)
<i>N</i>	748
adj. <i>R</i> <sup>2</sup>	0.339

*t* statistics in parentheses

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

## 4.5 Endogeneity Test

### 4.5.1 Heckman two-stage method

The potential endogeneity issue arising from sample selection bias between customer corporate digital transformation and supplier corporate patent citations is addressed in this study using the Heckman two-stage model. The results of the two-stage regression are presented in two columns of the table, with regression coefficients significant at the 1% level in both stages. This indicates that customer corporate digital transformation has a promoting effect on supplier corporate patent citations, strengthening the likelihood of the null hypothesis.

**Table 6.** Heckman two-stage method

	(1)	(2)
	First	Second
main		
Digital_c	0.0975** (2.2650)	0.2001*** (4.6641)
Size	0.3975*** (10.8831)	0.9455*** (17.7829)
Lev	-0.0944 (-0.4235)	-0.6411*** (-2.7090)
ROE	0.5885* (1.7102)	1.2754*** (3.3236)
Growth	0.1513 (1.3043)	0.0512 (0.4315)
Cashflow	-0.8598 (-1.4423)	0.0076 (0.0116)
Listage	-0.0274 (-0.4925)	-0.0340 (-0.5502)

RD	0.0430*** (7.2280)	0.0696*** (7.6341)
HHI	-0.7229** (-2.0423)	-0.5952 (-1.4275)
Industry FE	Yes	Yes
Year FE	Yes	Yes
imr		0.5425* (1.7207)
_cons	-10.6581*** (-12.5547)	-19.8128*** (-13.1288)
N	2211	2211
adj. R <sup>2</sup>		0.467

*t* statistics in parentheses

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

## 4.6 Further Research

### 4.6.1 Total factor productivity

Total Factor Productivity (TFP), distinct from individual factor productivity, typically refers to the comprehensive productivity of a firm across various factors and is a crucial indicator of the overall production capacity of the corporate. In recent time, digitization has become an unstoppable trend for business development, corporates are gradually transitioning from a "vertical" management structure to a "flatter" structure, which contributes to an increased overall factor productivity, making the mechanism of the impact of corporate digital transformation on patent citations more significant [11]. To examine this, the median of TFP is used as the test indicator to differentiate between high and low values. The results of the test reveal that when the TFP median is higher, the regression coefficient for corporate digital transformation is 0.1815. Conversely, when the TFP median is lower, the regression coefficient is 0.1421. Both coefficients are significant at the 1% level, indicating that when median of TFP is higher, the promotional effect of customer corporate digital transformation on supplier corporate patent citations is more significant when TFP is higher.

**Table 7.** Total factor productivity

	(1)	(2)
VARIABLES	r1 L1_InPtnCiting	r2 L1_InPtnCiting
Digital_c	0.1815*** (0.0544)	0.1421** (0.0644)
Size	0.9232*** (0.0429)	0.6408*** (0.0600)
Lev	-0.2777 (0.3125)	-0.7841** (0.3702)
ROE	1.7678*** (0.4778)	0.2232 (0.5822)
Growth	-0.2146 (0.1560)	0.2636 (0.1744)



Cashflow	-0.5504 (0.8315)	0.9262 (1.0143)
Listage	-0.0541 (0.0823)	0.0793 (0.0900)
RD	0.0436*** (0.0092)	0.0680*** (0.0102)
HHI	-0.8760* (0.5267)	-0.3249 (0.6391)
Industry FE	Yes	Yes
Year FE	Yes	Yes
Constant	-18.7061*** (2.5679)	-13.8130*** (2.0589)
Observations	1,245	970
R-squared	0.5586	0.3637
F	39.10	14.81

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

#### 4.6.2 Highly educated group

The educational background of employees in an corporate also plays a positive role in the development of the company. Absorbing highly educated talents can drive high-quality and sustainable development for the corporate. The proportion of supplier corporates' employees with a bachelor's degree or higher is introduced as a moderating variable into the original baseline regression model and is divided into two groups. According to the test results, when there are more highly educated individuals among the employees of supplier corporates, the regression coefficient for customer corporate digital transformation is 0.2223 (row 1), and when there are fewer highly educated individuals, the coefficient is 0.1603 (row 2). Both coefficients pass the 1% significance level test. Regression analysis indicates that as the proportion of highly educated individuals in supplier corporates increases, the promoting effect of customer corporate digital transformation on the mechanism of supplier corporate patent citations becomes more significant.

**Table 8.** Highly educated group

	(1)	(2)
	r1	r2
VARIABLES	L1_InPtnCiting	L1_InPtnCiting
Digital_c	0.2223*** (0.0593)	0.1603*** (0.0579)
Size	0.8861*** (0.0545)	0.8107*** (0.0430)
Lev	-0.1473 (0.3860)	-0.6194** (0.3001)
ROE	2.0379*** (0.6308)	0.2613 (0.4497)
Growth	-0.1747	0.1740

	(0.1754)	(0.1586)
Cashflow	-0.4966	1.0608
	(1.0353)	(0.8122)
Listage	-0.0709	0.0039
	(0.1034)	(0.0762)
RD	0.0691***	0.0517***
	(0.0121)	(0.0083)
HHI	-1.4027***	1.8488***
	(0.5135)	(0.6841)
Industry FE	Yes	Yes
Year FE	Yes	Yes
Constant	-18.6478***	-19.8867***
	(2.0702)	(2.2288)
Observations	872	1,343
R-squared	0.5452	0.4713
F	27.02	31.44

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## 5 CONCLUSIONS

The digital economy is a crucial foundation for future corporate competition and a significant engine for national economic growth. The development of digital technology not only promotes innovation and entrepreneurship in corporate but also aids in patent applications, enhancing their core competitiveness. From the perspective of information asymmetry theory, digital transformation brings substantial advantages and opportunities to customer corporates. It accelerates the speed of information transmission, allowing them to acquire information across various fields, such as markets and technologies, at lower or even zero costs. This efficient access to information enables corporates to more accurately identify market gaps and trends, adjust their research and development directions promptly, and enhance profit margins. Through digital technology, corporates can better understand customer needs, quickly meet market demands, and gain a competitive advantage in the market. In the process of digital transformation, upstream corporates, benefiting from the spillover effects of information, can gain deeper insights into the development changes of customer corporates. Leveraging the opportunities brought by digital transformation, upstream corporates continuously enhance their innovation capabilities, actively apply for patents, and maintain long-term competitive advantages. Digital transformation allows upstream corporates to better adapt to market changes, maintain competitiveness, and stand undefeated in the evolving business environment.

This study constructs a digital transformation indicator based on the annual report texts of listed corporates, measures information spillover effects in the supply chain using the "bullwhip effect," and examines whether customer corporate digital transformation can effectively strengthen the alignment between supplier and customer corporates, leading to positive information spillover effects. The research findings suggest that customer corporate digital transformation contributes to improving the "bullwhip effect" in the supply chain, promoting efficient information exchange between customer and supplier ends. The information spillover effects generated by customer corporates' digital applications, such as big data, cloud computing, and digital technology, alleviate the "bullwhip effect" in the supply chain. The study further explores the mechanisms through which digital transformation affects information spillover, revealing that

customer corporate digital transformation reduces information search costs and information verification costs, thus alleviating the "bullwhip effect" in the supply chain. Heterogeneity tests indicate that the information's spillover effects of digital transformation are more pronounced for larger-scale suppliers, those with longer inventory turnover days, higher market uncertainty, and higher customer concentration.

The relationship between customer corporate digital transformation and information spillover effects exhibits cross-sectional differences consistent with previous theories of information disclosure and resource effects. Additionally, the study discusses the relationship between the information spillover effects of customer corporate digital transformation and supplier corporate strategic distinctiveness and total factor productivity. It finds that customer corporate digital transformation mitigates the problems of production plan disruptions and inefficient resource allocation caused by the "bullwhip effect" in supplier corporates. This leads supplier corporates to adopt more novel and unique resource allocation decisions. Moreover, the information spillover effects generated by customer corporate digital transformation effectively improve supplier corporate production processes. The policy implications of this study suggest that, in the current context of China's industrialization driven by information technology, the level of corporate informatization reflects their active response to the national policy of deep integration of the digital economy and the real economy. The degree of industrialization directly reflects the level of corporate specialization. The digital economy presents unprecedented opportunities for corporate development, injecting new vitality. In this context, the government should introduce policies to encourage digital transformation in the supply chain. Policy guidance and financial support can accelerate the pace of corporate digital transformation. The government can also launch relevant tax incentives, provide digital technology training, and consulting services to incentivize corporates to actively invest in digital transformation. These policy measures will help corporates actively respond to the national strategy of deep integration of the digital economy and the real economy, accelerating the reconstruction of the new economic mentality of economy and governance. Innovation is a critical means for corporates to maintain core competitiveness. Continuous innovation allows corporates to stand out in the market and gain a larger market share. After upstream corporates receive the economic consequences of customer corporate digital transformation, they often seize market resources through innovative technologies. In this process, applying for patents becomes a necessary means to protect innovative achievements, stimulating employees' innovation consciousness and enthusiasm, and promoting high-quality development. Therefore, to encourage suppliers to apply for patents, the government should strengthen intellectual property protection, establish a sound legal and regulatory system, improve patent examination efficiency, and intensify efforts to combat infringement. Strengthening intellectual property protection can enhance corporate innovation enthusiasm and patent application willingness, promoting China's economic transformation towards a knowledge-intensive and innovation-driven model. High education and high-quality talents play a crucial role in corporate innovation. To some extent, they signify a broader knowledge reserve and profound professional background, enabling them to propose creative and forward-looking viewpoints. Therefore, the higher the proportion of highly educated and high-quality talents in the management of the corporate, the greater the number of patent applications by upstream corporates. Given this, the government and corporates should attach importance to talent cultivation and recruitment, providing attractive benefits and development opportunities for highly educated talents. This will provide strong support for the innovation and development of supplier corporates.

## **COMPETING INTERESTS**

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

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# HOME TEXTILE BRAND ANALYSIS AND MARKETING STRATEGY DEPLOYMENT

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**Abstract:** Since 2023, the international environment is severe and complex, the world economic growth rate is at a low level, the risk of high inflation is still persisting, the home textile market orders are insufficient, and the growth of external demand is weak. However, with the gradual recovery of China's national economy, relevant policies and measures step by step, domestic demand is recovering, home textile industry as a whole to maintain stable operation. China's home textile market has reached a certain scale after years of development, and still maintains stable growth under the increased uncertainty of the global economy, and shows a positive trend in technological innovation, brand building and marketing planning. With the improvement of people's living standards, the quality of home textile products is increasingly demanding. Home textile products, as an important factor in improving the quality of home life, are increasingly favoured by people. This paper will analyse our home textile market and the needs of domestic consumers, judge the strengths, weaknesses and opportunities for upward mobility through a specific analysis of Brand R, fully assess the potential profits and risks of the brand in the home textile market, and formulate relevant marketing strategies.

**Keywords:** Home textile; SWOT; Brand building; Marketing planning; Marketing strategies

## 1 INTRODUCTION

As a livelihood industry, the home textile industry is in a stage of rapid growth and is expected to continue to maintain its growth momentum in the coming years. According to China Chamber of Commerce for Textile Importers and Exporters Home Textile Branch, in the first 11 months of 2023, our home textile exports stabilised and rebounded, with a cumulative export value of USD 30.09 billion, up 17.3% from the same period in 2019. At the same time, the home textile industry environment changes in the process of turbulence, the European and American markets play a vital role in enhancing the brand of self-products, and the European and American markets have great potential for development, which helps to strengthen the development of the domestic home textile industry as well as foreign trade. Therefore, our home textile industry to Europe and the United States is a trend.

In China, the scale of home textile industry is expanding, but product innovation is still weak. With the acceleration of consumption upgrading, the functionality, comfort and experience of products are becoming more and more important. Therefore, the application of new materials, new designs and new technologies in the home textile field has gradually become widespread. Digital technology has begun to play an important role in home textile products, for example, the emergence of smart home systems and smart textiles has brought consumers a new experience. In addition, through researching innovative products in the market and cases of industry leaders, we found that the development direction of home textile products, on the one hand, has gradually tended to be internationalised, in line with themes such as green and environmental protection of science and technology, with multiple perspectives considering the use of safety, non-pollution, renewable or degradable, etc., and focusing on the added value of products and home textile brands. On the other hand, home textile products as closely related to people's daily lives, but also gradually tend to the public, according to the current social background, aesthetic fashion, modern home style gradually back to basics, the traditional, with national cultural characteristics into which the content[1].

Consumer willingness is a key factor in the successful sale of home textile products, the research in this paper was mainly conducted by questionnaire and field survey, and a large amount of data was collected through social platforms, online media and offline distribution. Finally 60 questionnaires were sent out, 60 questionnaires were returned, and 53 questionnaires were valid.

The questionnaire mainly focuses on the importance people attach to home textile products, the factors they consider when buying home textiles, the channels they use to buy home textile products, and their knowledge of medium and high-end home textiles. By integrating and analysing all the data, we learned that most consumers attach great importance to home textile products, and those who focus on the quality and comfort of home textile products are as high as 94.34% and 92.45%, and those who focus on the aspects of fabric, price, design, functionality and after-sales service are more than 50% per capita. We also found that the vast majority of consumers prefer to buy products in physical shops to be able to see the quality of the products with their own eyes. This is more unexpected for our study. However, 60.38% also opted for online e-commerce platforms, which provided a new way to advertise and promote our project. In addition, most people are less aware of mid-to-high-end home textile products and pay less attention to related brands. Word-of-mouth recommendation and price are the main factors affecting their purchasing decision. 62.26% of them hope that medium- and high-end home textile products are moderately priced. At the same time, 69.81% of the people hope that the middle and high-end home textile products can increase the functionality, such as anti-mite and anti-insect, etc., and 58.49% of the people hope that there will be more innovative designs and material choices.

Having conducted a segmentation study of the market, we have also identified differences in the needs and preferences of different consumer groups. We note that there are diversified product demands in the home textile market, with differences in demand for home textile products among consumers of different ages, genders, regions and income levels. In higher income regions, people have a more detailed understanding of mid- to high-end home textile products and often purchase such products, while paying more attention to product quality and features. While in the lower income areas, consumers pay more attention to the affordability of home textile products, the pursuit of good value for money. Therefore, we need to develop corresponding marketing strategies according to different market segments to meet the needs of different consumer groups[2].

## 2 SWOT ANALYSIS

### 2.1 Strength

R brand belongs to company A, the company has a wide building area, strong capital, complete equipment, technology and R & D resources accumulated over the years to ensure that the R brand of stable sources of supply, and R brand products filled with goose down, goose down high quality. At the same time, R brand self-production and self-marketing, in the production process to strengthen quality control, strict control of the supply chain to ensure that product quality in line with the standard, and reduce the middleman link can greatly reduce product costs, to ensure that the company's profits are maximised. R brand has its own unique scientific and technological innovation. Its pillow has a patented multi-chamber neck protection technology, dynamic soft and hard neck protection technology; core has a patented comfortable thermostat and anti-leakage technology, the support of these technologies to form a variety of unique goose down pillow and quilt products. With the powerful A down as brand endorsement, the market awareness and influence of R brand will increase day by day.

### 2.2 Weakness

Brand R's products are predominantly plain, with a brand story and image that focuses on "product quality" and "great experience", with no unique elements or differentiation in product design. This also leads to limited promotion channels and low product exposure. In addition, the general market price of ordinary four-piece suits is between 300 and 800, compared with other similar products, as a mid-range and high-end goose down bedding brand, R brand product prices are obviously slightly higher. Consumers are prone to choose other similar alternative products after price comparison.

### 2.3 Opportunity

China has stepped into the era of mobile Internet, which promotes the development of society with unprecedented depth and breadth, and the home textile industry has also kept pace with the times, and continues to develop new profit models. The commercialisation of short videos, live broadcasts and other forms has accelerated, and many enterprises and brands have entered the market to seize a new round of growth opportunities. According to the estimates of senior people in the home textile industry, the retail e-commerce penetration rate of the Chinese home textile industry in 2021 was close to 30%. Home textile e-commerce sales scale exceeded 100 billion yuan, of which live e-commerce sales of nearly 30 billion. R brand in some well-known online platforms to carry out online marketing, such as Alibaba international station, small red book, Taobao, jittery voice, etc., the development of a suitable operational strategy for online platforms, can bring better market position for R brand.

### 2.4 Threat

Domestic there are head home textile brands such as Fu Anna, Loreal home textile, Mercury home textile and so on have been involved in cross-border e-commerce, and constantly improve the overall competitiveness of such brands, such brands of popularity, sales and reputation are now R brand can not be surpassed, their occupation of the market can not be broken at present. In addition to this, there are various international brands continue to seize the high-end market. International home textile brands exported to foreign countries are of high grade and expensive, with similar brand positioning to R-brands, and the market is easy to be occupied.

## 3 MARKETING STRATEGY DEVELOPMENT

In analysing the marketing methods of some home textile brands, we found that: on the online platform, the major home textile brands, in addition to placing advertisements for publicity, pay more attention to the customer's sense of shopping experience to increase customer stickiness; offline shops, the use of return visits, private domains, etc. to get the feedback of the user, to master the needs of the customer. The integration of online and offline can better serve customers, but also favoured by more customers. Therefore, adjusting the traditional e-commerce strategy, developing new sales channels, providing good service, and the integration of online and offline is a powerful means, and we will also develop appropriate marketing strategies from these aspects.

### 3.1 Image Building to Enhance Sales

A unique brand image can stand out among many home textile brands, so image building is very important for R-brand. A unique brand image not only attracts consumers' attention, but also increases their trust. For self media bloggers, it is important to create a "persona", but also for a brand. With the brand's unique concept, unique design, to create a unique brand characteristics, it is more likely to expand the brand's market.

### 3.2 Live Banding

Nowadays, under the status quo of the popularity of webcasting, live broadcasting with goods has played a great role in promoting the development of the e-commerce industry. There are many netroots bloggers use their influence on the network to bring popularity, traffic, etc., so as to achieve publicity and promotion for the company, etc., and to bring consumers a more pleasant consumption experience. Where funds allow, companies can increase brand awareness by signing anchors, live streaming with goods, and so on. At the same time, the consumer's trust in the anchor is directly linked to the publicity effect and brand revenue, the anchor's presence will make consumers from the anchor's fans into corporate customers. The more famous and popular the anchor is, the better the publicity effect and the higher the sales. The influence of small and medium-sized anchors is low, and the impact of the live banding of small and medium-sized anchors on the live banding of large anchors is very small and will not be considered[3].

### 3.3 Strengthening Mobile Channels

Brand R already has a WeChat public number in operation, but the public number pushes a single form of content, and currently only publishes three online benefits, one brand story and one buyer show collection, without the more essential content, and the reading volume is not large. The title of WeChat public number is the key point to attract readers, so the title of the public number should be attractive. The article is the essence of the public number, you can use a combination of text and pictures, supplemented by voice, video and hybrid editing methods to make the article more colourful. At the same time, the background of the public number set up a welcome message to bring the editor and readers closer together and increase the user experience[4]. In addition, we note that at present, R brand does not have a WeChat mall applet, you can develop WeChat applets and use the "public number + applet" mode for marketing.

### 3.4 Building an O2O Model

Enterprises should have a clear strategic positioning for the integration of different channel operation modes, can choose O2O business model. In this business model, product concepts, varieties, packaging, price and other aspects must be consistent and uniform, online and offline single product selling price can not be too big difference. o2O business model in the operation process requires the R brand need to be online as an important sales channel, rather than an independent business section, online and offline belongs to the way to promote each other, combined with each other, to achieve the fusion of the line. R brand needs to be adjusted according to its own conditions and needs, in line with the strategic positioning of the enterprise brand, a thorough grasp of the target customers, core needs, choose to match the target group precision positioning. For example: determine the most concerned target market; choose the right cross-border platform; set up a team to cultivate cross-border export talents; build supply chain advantages and so on.

### 3.5 Improving the Membership System

Using the RFM model, consumer members are divided into the following categories, and the corresponding members to develop appropriate responses: 1, important value customers: consumption time is close, consumption frequency and amount are very high. This kind of member is the key concern object, their consumption power is very strong, should provide higher quality service. 2, important to keep the customer: consumption time is far away, but the consumption frequency and amount are very high, that is a infrequent consumption but very loyal customer. Facing this kind of member, we need to take the initiative to keep in touch with him.3. Important development customer: consumption time is close, consumption amount is high, but the frequency is not high, and the loyalty is not high[5]. This kind of member is a very potential customer, must focus on the development, to provide perfect after-sales service. 4, important to retain customers: consumption time is far away, consumption frequency is not high, but the consumption of high amount of users, these may be about to be lost or have to lose customers, should be given to retain measures.

### 3.6 Improving the Quality of Services

Good sales service is an important part of the process. Focusing on the maintenance of customer relationship, in the interaction with customers, should take a variety of measures to maintain and consolidate the relationship with customers, and cultivate their loyalty. In sales, it is important to provide customers with emotional value, from the customer's point of view, to understand the customer's needs and provide appropriate services. For quality, words are not enough to make customers really feel the advantages and features of the products[6]. After-sales service to do regular after-sales visits, you can establish a customer information database, designated sales staff to maintain tracking contact; the establishment of a private domain, in the circle of friends, micro letter groups to achieve fission to expand customers. After-sales service should formally start from the consumer after the order, before the customer receives the product, the service should be provided at the first time out. Let customers feel the company's service considerate and meticulous, in order to make them loyal to the brand and trust. In addition, if you encounter customer complaints, but also to provide timely service, patience to solve the problem.

## 4 CONCLUSION

In the face of a complex international scenario marked by slow global economic growth and persistent high inflation, the home textile industry in China has demonstrated resilience and stability, underpinned by the gradual recovery of the national economy and relevant policy support. Despite challenges such as insufficient market orders and weak external demand growth, the industry continues to show promising signs of technological innovation, brand development, and

strategic marketing planning. The document provides an insightful analysis into the dynamics of the home textile market, emphasizing the essential role of consumer preferences, market trends, and strategic brand positioning in navigating the industry's future trajectory. The market analysis highlights the rapid growth stage of the home textile industry, buoyed by a notable rebound in exports and the strategic importance of the European and American markets for brand enhancement and development. However, it also points out the need for product innovation and the incorporation of digital technology to meet evolving consumer demands for functionality, comfort, and sustainability. Consumer behaviour analysis underscores the significance of quality and comfort, with a majority of consumers preferring physical store purchases alongside online platforms, revealing a gap in awareness and preference for mid-to-high-end home textile products. Focusing on Brand R, the analysis delineates its strengths, including a strong foundation in production, quality control, and technological innovation, alongside weaknesses such as limited product design differentiation and high price points. The brand faces opportunities in digital commerce evolution and online marketing expansion but must navigate threats from established domestic and international competitors. The proposed marketing strategies advocate for a multifaceted approach, emphasizing the enhancement of brand image, exploitation of live broadcasting, strengthening of mobile channels, development of an O2O model, improvement of the membership system, and elevation of service quality. These strategies aim to increase brand visibility, consumer engagement, and loyalty, adapting to the digital transformation trends within the industry. In conclusion, the home textile industry in China stands at a crossroads, where embracing innovation, consumer-centric strategies, and digital marketing can pave the way for sustained growth and competitive advantage. By addressing its challenges and leveraging its strengths, Brand R can aspire to achieve a stronger market presence and recognition, contributing to the overall vitality and dynamism of the home textile market.

## COMPETING INTERESTS

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

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# OPPORTUNITIES AND CHALLENGES IN THE PURSUIT OF SUSTAINABLE URBAN DEVELOPMENT

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**Abstract:** Transforming the current over-consumption cities into "waste-free cities" is a progressive urban development strategy. In view of the theoretical gap of "waste-free cities" in my country, this article systematically combed the relevant foreign literature and elaborated on the urban waste. The seriousness of the threat, and summarized the opportunities and challenges currently faced by my country in building a "waste-free city".

**Keywords:** Waste-free city; Waste problem; Opportunities and challenges

## 1 THE THREAT OF URBAN WASTE PROBLEMS

In December 2018, the General Office of the State Council released the "Work Plan for the Pilot Project of "Waste-Free City"", proposing to coordinate the solid waste management in economic and social development through the pilot project of "Waste-Free City", explore the establishment of a quantitative indicator system, and form a feasible Requirements for a replicable and scalable construction model. However, for now, in the process of implementing "waste-free", there are still debates about the balance between social environmental benefits and economic burdens, and there are also theoretical gaps in how to promote the construction of "waste-free cities". This article systematically reviews relevant foreign literature and focuses on analyzing the opportunities and challenges that may be encountered in the process of building a "waste-free city", with a view to providing some reference for the construction of a "waste-free city".

### 1.1 Overview of Waste Issues

Along with the global urbanization process, the generation of municipal solid waste has increased significantly in the past few decades. High-income countries generate 500kg or more of municipal waste per person per year, while emerging countries including China generate 200~300kg per person per year. It is estimated that 2 billion tons of municipal solid waste are currently generated worldwide every year. By 2025, the municipal solid waste generated by each person in the world will reach 7 billion tons if calculated based on the current per capita emissions of San Francisco [1]. Today's consumption-driven society generates a lot of waste, and the production process has transformed into a complex system. The use of composite and hazardous materials has made the composition of municipal waste increasingly complex, causing damage to the environment and expensive to manage. The sources of waste we generate today are also complex. The diversity of waste forces policymakers to choose only inefficient and environmentally polluting waste management methods, such as landfills. However, the shortage of urban landfills has forced the waste management department to There is a need to find an alternative waste management system [2].

### 1.2 Dilemma of Waste Reduction Measures

Achieving, but worrying, research states that solid waste is growing faster than population and economic growth and that unless "aggressive sustainability strategies are successfully implemented," there will be a "maximum value for global waste generation." It may not appear until 2100. Waste problems and waste-related problems will lead to disasters (such as ocean plastics, dissipation of chemical toxicity, food waste, nuclear waste, etc. [3] ). The breadth and diversity of the waste problem overlap with Earth's systemic causation (e.g. history, geography, infrastructure and technology, vested interests, ideology, etc.), which increases the complexity and divergence of the waste problem. The International Solid Waste Association (ISWA) pointed out in the Global Waste Management Outlook (GWMO) that currently an estimated 2 to 3 billion people in the world live under the most basic waste management system, and about 41% of the world's waste is handled by default. The method is uncontrolled burning, fueling concerns about the environmental consequences of systemic failures in global waste management. Although many developed and developing countries are vigorously implementing waste recycling policies, it is estimated that only 1/4 to 1/3 of the 3.4 billion to 4 billion tons of municipal solid waste and industrial waste produced globally every year is recycled [4]. The more difficult problem is that among different types of solid waste, the recycling rate of plastics, paper, and glass is relatively high, while the recycling rate of metals is at an extremely low level. In particular, the rare metals required for industrial production are being continuously used by us. Disposal and landfilling, if no action is taken, resource depletion will be the first to deal a fatal blow to human society before waste causes serious urban problems.

### 1.3 The Connotation and Significance of "Waste-Free City"

Under the threat of serious waste problems, the "Waste-Free City" based on urban waste management was proposed. "Waste-Free City" strives to face up to the urban waste problem, build a working framework to accept different opinions and behaviors, and accept the community. Or non-governmental organizations participate in the treatment of urban waste, oppose waste incineration and landfill, try to change the current waste production method and people's disposable consumption habits, reconstruct the current urban production and consumption model, and continuously reduce waste generation in " Under "business as usual" conditions, urban waste reduction, recycling and utilization can be quickly promoted. Its ultimate goal is to shift human society away from linear material flows and transform it into an economic development model in which materials circulate continuously within the urban system.

## **2 OPPORTUNITIES TO BUILD A “WASTE-FREE CITY”**

### **2.1 Social Dimension - Exploring Models for Future Eco-Cities**

Zaman believes that there have been two problems in the construction of ecological cities in various countries for a long time. First, eco-cities with high ecological footprints do not meet the connotation of "ecology"; second, based on the current standards of eco-city construction, the earth will be unable to accommodate the current population. As a sub-concept of ecological cities, "no waste city" has become an experimental plan to explore the harmonious coexistence of cities and nature. Although "no waste" is semantically contradictory between existence and reality, it serves as a This optimistic ideal goal will continue to spawn new technologies that enhance urban bionics. For example, some scholars have proposed that the improvement of urban composting and organic recycling systems will make urban agriculture more widely used [5], and the city's nutrient cycle will bring less energy consumption and food waste. Various possible new technologies will transform future cities into a disruptive new form—a self-sufficient industrial ecology with zero energy consumption, zero waste, and environmental sustainability [6].

### **2.2 Government Dimension - Forming a New Urban Governance Model**

The problem of urban solid waste requires active promotion by the government and inevitably involves the participation of enterprises and citizens. This is a complex challenge that tests social cohesion. The city is like a living "laboratory", and the government must actively seek long-term cooperation among different stakeholders to provide an alternative, participatory, democratized, and integrated new environment for jointly generating solutions [ 7]. How should waste management responsibilities be defined to better achieve the goal of “no waste”? Is the municipal waste management system provided by the government or the private sector? How to be more economically efficient? These are all issues that need to be explored in the process of building a “waste-free city”. As people's understanding of environmental threats gradually deepens, experimental governance practices will be increasingly accepted, and the cost of destructive innovation and transformative transformation of existing governance models will be at a low level. This is also an important step in reshaping the relationship between government and society. , an opportunity to form better urban governance relationships.

### **2.3 Enterprise Dimension - Generating New Industries and Production Processes**

Recycling resources from dumped consumer products is increasingly important as waste is increasingly viewed as a valuable resource. As overconsumption becomes the norm and the amount of electronic equipment scrap is growing rapidly, these sought-after specialty metals, such as palladium, dysprosium and neodymium, are becoming increasingly valuable. Recently, some scholars have proposed the idea of "urban mining", which is to dig out electronic waste from landfills and recover the precious metals in it. Some recycling experts predict: "The mining of urban landfills may become a big business in the future." [8] In addition, waste recycling processing in some developed countries has entered the stage of industrialized operation mode, and Switzerland has for many years been leading from other European countries. The country imports waste for resource recycling. Due to its highly developed waste processing industry, the proportion of resources recovered from waste reaches 77%, while the proportion in the UK is only 25%. The benefits brought by high-level waste treatment technology are dual (environmental and economic). It is foreseeable that the development of waste treatment-related industries will bring about the birth of a number of new technology companies and great progress in treatment technology.

### **2.4 Citizen Dimension - Improvement of Community Space and Living Environment**

Most of the time, people are unwilling to change their behavior and lifestyle, despite the huge pressure their high levels of consumption put on the planet. Therefore, education and publicity aimed at changing citizens' consumption behavior are very important. In developing countries, even without a budget, there are ways to improve waste management and change citizen consumption behavior. For example, Curitiba, Brazil, uses an innovative waste collection method, the Green Exchange Program, to encourage slum dwellers to clean up their areas. To improve public health, the city government provides free bus tickets and fresh vegetables to those who collect garbage and take it to community centers, and children are allowed to exchange recyclable items for school supplies or toys [9]. Changes in people's attitudes towards consumption and waste will not only help reduce unnecessary waste, but also make the community's

living environment more superior. These two parallel processes will continue to interact with each other and reshape the face of the city.

### 3 CHALLENGES IN BUILDING A “WASTE-FREE CITY”

#### 3.1 How to Establish Producer and Consumer Responsibility Systems

Waste is generated due to consumption. It is obviously difficult for the government to provide corresponding public services for the growing urban waste. Linking waste to consumption behavior is an inevitable choice for implementing the waste responsibility system. However, in practice, the producer responsibility system implemented in Germany There is a problem of low waste disposal rate and disposal efficiency. It is difficult for producers to efficiently recycle waste products from garbage collection points [8], and the consumer responsibility system represented by the disposal tax (garbage tax) faces the problem of insufficient incentives. The problem is that the abandonment tax separates the obligation to reduce waste from citizens in the form of taxation. After paying the tax, citizens no longer have a conscious sense of responsibility, and may instead cause an increase in waste.

#### 3.2 How to Balance the “No Waste” Goal and Implementation Costs

Under current conditions, "no waste" is expensive. In fact, according to research by the British Engineering and Physical Sciences Research Council, recycling waste paper will in some cases produce worse environmental benefits than incineration. Some studies believe that for citizens, the cost of classifying garbage is 5 to 10 times higher than disposing of waste indiscriminately. Not only that, cities must establish an effective garbage transfer and processing system to make citizens more comfortable. Efforts will not be in vain. The goal of "no waste" is progressive. The government needs to choose an appropriate implementation cost range to implement the "no waste" policy. This is a specific problem faced by every city's government.

#### 3.3 How to Evaluate “Waste-Free City”

"Waste-free" is specific and difficult to achieve. In the process of promoting the construction of "waste-free city", how to quantitatively evaluate the degree of "waste-free" in a city is one of the difficulties in practice. In the existing literature, there are generally three tendencies: index coreization (single index), index systemization (complex system), and index framework (simple system). Each tendency has its advantages, disadvantages, and application scenarios [10]. When establishing an indicator system for evaluating my country's "waste-free cities", we should comprehensively measure whether the data can match the indicator system, whether comparisons between cities are convenient, and whether the indicators can fully reflect the entire process from production to recycling, etc. , exploring a complete set of quantitative evaluation systems for "waste-free cities" is an important direction for future research.

#### 3.4 How to Establish a Reasonable Action Plan and Timetable

Waste management is an important part of the sustainable urban model, and the “waste-free city” is the ultimate vision based on this model, but without a properly defined action plan and a well-coordinated execution timetable, it will be difficult to transform the current Cities become “waste-free cities” [8]. The urban transition phase requires the comprehensive construction of a city's waste-free management strategy based on the comprehensive coordination of tools, systems and technologies. This includes a series of action plans with specific goals and a matching and deepening time sequence. The city will At certain specific points in time, we will enter a new stage closer to the goal of "no waste". It should be noted that these tools, systems and technologies must also be economically realistic, engineering feasible and effective within the governance framework of each locality. valid on.

### COMPETING INTERESTS

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

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# CONSTRUCTION PROCESS CONTROL AND MANAGEMENT OF GEOTECHNICAL ENGINEERING PROJECTS

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**Abstract:** With the development of society, China's geotechnical engineering construction has made rapid progress. But at the same time, in the construction management process of geotechnical engineering, there are common problems such as project quality problems and uneven quality of practitioners. The establishment of construction quality management and assurance system, construction process quality control and inspection are introduced in detail, hoping to provide some reference for the management of geotechnical engineering.

**Keywords:** Engineering projects; Construction process control; Management

## 1 CHARACTERISTICS OF GEOTECHNICAL ENGINEERING

With the development and progress of my country's engineering technology, geotechnical engineering has also experienced a qualitative leap. Various large-scale and ultra-large-scale geotechnical projects continue to set new records and become the development goals of construction companies.

Therefore, how to ensure project quality during the construction process, control construction costs at the same time, and strengthen the training of project management teams have become issues that every construction company must pay attention to.

The construction of geotechnical engineering is characterized by uncertainty, regional diversity and concealment. During the construction process, it will not only be affected by external conditions such as weather and government supervision, but also the rock and soil layers will be disturbed during the construction process, resulting in changes in the rock and soil properties and stress structures, which will lead to many emergencies such as collapse, sudden surge, etc.

Therefore, even if relatively complete geological survey data are obtained before construction, it is impossible to fully predict all risks that may occur during the construction process. This uncertainty places higher demands on the quality of construction personnel and at the same time limits the construction period and the preparation of construction plans. Our country has a vast territory and diverse geological conditions, resulting in great differences in the properties of rock and soil in various regions. For example, there are great differences between inland areas and coastal areas. It is necessary to focus on various aspects such as collapsible loess, bedrock, and soft foundation types of formations.

The concealment of geotechnical engineering construction is mainly reflected in the construction of concealed projects such as underground continuous walls and foundation anti-seepage treatment. It is precisely because they are hidden underground that they virtually increase the difficulty of construction. Secondly, during the construction process, various emergencies often occur due to stratum reasons, and relevant emergency measures can only be formulated based on the actual situation during the construction process.

## 2 SOME PROBLEMS IN GEOTECHNICAL ENGINEERING

### 2.1 Prominent Construction Safety Issues

There are generally many safety hazards in geotechnical engineering itself, coupled with the various adverse effects on the project caused by natural disasters such as typhoons, heavy rains, and flash floods, resulting in a high rate of safety accidents in geotechnical engineering. This puts forward higher requirements for project construction. If effective measures cannot be taken in time to prevent safety accidents, project safety will not be guaranteed.

### 2.2 Unreasonable Subcontracting System

Due to various reasons such as lax contract management and economic profits, a project often has multiple layers of subcontracting, forming a series or onion subcontract structure, resulting in various management instructions from the general contractor being unable to be communicated in a timely manner to the work team, seriously affecting the quality and safety of the project.

### 2.3 Chaos in Project Management

Project management is mainly reflected in the project construction process. According to the construction plan prepared by the project, the management personnel conduct all-round, whole-process and full-person management of the project

construction. Many quality and safety accidents currently occurring in projects are ultimately caused by chaotic project management. If the project management of the project does not have a sound management organization structure, managers with corresponding qualifications, and a complete management system, it is impossible to successfully achieve the various management objectives of the project.

## **2.4 Irregular Project Bidding**

According to relevant national laws and regulations, all engineering projects need to complete the bidding work through public bidding. However, in actual operation, many engineering projects cannot be carried out in full compliance with legal procedures.

Bid-rigging, bid-rigging, malicious low-price bidding, etc. occur from time to time, which not only affects the quality and safety of the project, but also prevents companies in the industry from achieving "survival of the fittest" and seriously affects the order of the construction market.

## **3 MANAGEMENT OF GEOTECHNICAL ENGINEERING**

### **3.1 Establish a Complete Quality Management System**

Enterprises or organizations must establish a complete quality management system based on the characteristics of various types of geotechnical engineering construction in accordance with national and industry norms and standards to ensure that the construction meets various requirements for project quality.

(1) In terms of project management organization, it is necessary to establish a project quality management system at three levels: project decision-making level, project management and operation team, so as to ensure the realization of project quality objectives in terms of organizational structure. The setup of each department of the project organization must be scientific and reasonable to avoid a vacuum between the work of each part and lay a good foundation for the effective operation of the quality management system.

(2) In terms of quality management personnel allocation, since the project manager is the first person responsible for project quality management, he must hold a practice certificate issued by the state and have high overall quality. This includes two aspects: construction technology and management. Deficiencies in either aspect may lead to a disconnect between technology and management during the construction process. Engineering and technical personnel work directly on the front line, and their professional abilities and qualities directly affect the quality of the project. Therefore, professional skills training needs to be carried out according to each person's position, and a certificate will be issued after passing the examination, so that everyone can work with a certificate to ensure the quality of the project.

(3) The project must establish a complete quality management system, including a technical disclosure system, a job responsibility system, a three-inspection quality inspection system, a weekly meeting system, and a reasonable reward and punishment system. Strengthen quality control on construction sites through a multi-faceted and multi-angle management system. Detailed and strict regulations should be made for all types of quality data, and all types of original records should be true, clear, and accurate. Continuously improve the operability of quality management documents through the PDCA cycle at work.

### **3.2 Process Control of Quality Management**

On the basis of establishing a complete quality management system, construction companies must continuously verify the operating status and effectiveness of the quality management system; and effective quality management requires a series of effective controls from the beginning of bidding to project completion.

#### **3.2.1 Bidding stage**

Before signing a contract, the contract should be reviewed and effective communication channels should be established with the owner on matters related to the contract to ensure that contract information is accurately communicated to the relevant functional departments of the company in a timely manner. In addition, during the geotechnical engineering construction process, there may be adjustments to the construction plan due to design changes, poor geological conditions, etc. Therefore, during the bidding stage, the bidding documents should be carefully studied, the surrounding environment of the project should be investigated in detail, and various factors should be fully considered. The impact of various risk factors on project quality, through the comparison and selection of multiple technical solutions, the construction plan is finally determined to prepare bidding documents.

#### **3.2.2 Construction stage**

When entering the construction stage, the project should first clarify the project quality management objectives, prepare a project quality management plan based on the characteristics of geotechnical engineering, classify various factors that affect project quality, and form a written record to communicate to each technical personnel.

On this basis, the project technical leader should, under the leadership of the project manager, prepare a detailed construction organization design plan based on the engineering contract, design documents, relevant national and industry standards, and the actual conditions on site. During the construction process, the quality of key parts of the project, hidden projects and key processes should be mainly considered from the allocation of technical solutions, construction equipment, construction personnel and other various resources of the project.

#### **3.2.3 Completion stage**

Due to the vast territory of our country, various places and industries have different standards and requirements for engineering archiving data. This requires that during the completion stage, the sorting and archiving of various completion materials must be completed in strict accordance with the predetermined project standards. At the same time, we will do a good job in finished product protection and project warranty work to ensure smooth acceptance of the project. Finally, construction summaries must be conducted in a timely manner, and experiences and lessons must be continuously summarized from a technical and management perspective, thereby improving the level of technical personnel.

### **3.3 Management of Key and Difficult Points**

#### ***3.3.1 Strengthen the control of key processes and hidden projects***

Controlling the construction quality of key processes and hidden projects is an important link to ensure the quality of the entire project. During the construction process, it should be ensured that it is under control at all times. There are many factors that affect quality, including the performance of construction equipment, the quality of various raw materials and the level of construction personnel. This requires analysis and research on various influencing factors during the construction process, and strict implementation of the three-inspection system to continuously inspect the project quality, so that scientific and effective measures can be taken for timely control and avoid various quality accidents.

#### ***3.3.2 Quality control of raw materials***

All types of raw materials purchased for the project should be purchased strictly in accordance with the material procurement procedures. All types of materials entering the site should be submitted for inspection and necessary random inspections should be carried out. Their performance must comply with relevant national standards, specifications and engineering design quality requirements. Materials that fail the inspection should be sealed or removed from the site in a timely manner to prevent misuse. At the same time, the storage and labeling of various materials and supplies will be done well to create favorable conditions for subsequent construction.

#### ***3.3.3 Technical briefing***

Before the official start of the project, project technical personnel need to carefully study and understand the design drawings. Problems found in the drawings should be raised with the design unit during the drawing review process and a written record should be formed.

On the basis of fully understanding the design drawings, before construction, project technical personnel should make detailed technical explanations to each team and form written records based on the prepared construction organization design or work instructions to ensure that everyone in the team can understand clearly Respective operating points. This work has proven to be a very effective method of controlling engineering quality in practice.

#### ***3.3.4 Cost control***

Project cost control is always an important part of project management, and the quality of cost control directly affects the profitability of the project.

In order to achieve the goals of project cost management, project managers need to do a good job in cost planning, control, accounting, analysis and other tasks of project construction. Through strict contract management, material procurement costs are reduced; scientific and reasonable construction plans are adopted to implement various technical measures and improve the utilization rate of mechanical equipment, thereby accelerating the construction progress and ultimately achieving project cost control goals.

## **COMPETING INTERESTS**

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

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# EVOLUTIONARY ECONOMICS PERSPECTIVE ON THE REGIONAL DISTRIBUTION OF SUPPLY CHAIN MANAGEMENT SPECIALTIES

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**Abstract:** Evolutionary economics is the main economic theory of modern Western economics. It is characterized by interpreting and studying innovative integration issues existing in social and economic development from dynamically changing data and phenomena, using evolutionary economics theoretical research to guide economic and industrial integration innovation, and providing a reference theoretical basis for social and economic development. The progress and development of the times often force changes in the world economy, bring about adjustments and layout of the economic structure, and bring development opportunities for national economic development. During the COVID-19 epidemic, the role and status of the supply chain have become more prominent, and the competitiveness of the supply chain has risen to the level of a national strategy. The establishment of the supply chain management major is closely related to the layout of regional economic development. The analysis of the regional layout of the supply chain management major based on evolutionary economics plays an important reference role in the orderly planning and establishment of the supply chain management major.

**Keywords:** Evolutionary economics; Supply chain; Economic region

## 1 INTRODUCTION

Evolutionary economics is the economics that studies the process of economic evolution and development. Understand the internal structure of economic organizations, technological progress, and changes in industries and products from economic phenomena, and use a dynamic and evolutionary approach to view the economic development process. The core is innovation. With the development of the world economy and changes in the economic landscape, evolutionary economics has become the main theme of economics in the 21st century[1].

From the perspective of the history of supply chain research and development, the "economic chain" first came from the American Peter Drucker, and later the "value chain" proposed by the American Michael Porter finally evolved into the "supply chain". The supply chain is a functional network chain structure model formed by providing products and services to suppliers, manufacturers, distributors, retailers, and ultimately users during the production and circulation process. Martin Christopher, a British supply chain management expert, pointed out that "the competition in the 21st century is no longer a competition between enterprises, but a competition between supply chains and supply chains"[2]. The report of the 19th National Congress of the Communist Party of China proposed to cultivate new growth points and form new momentum in the fields of modern supply chain, innovation leadership, green and low carbon, and shared economy. This is the first time that the Party Central Committee has proposed the concept of modern supply chain, marking the modern supply chain. Chain development has been officially elevated to a national strategy. In 2017, the State Council's "Guiding Opinions on Actively Promoting Supply Chain Innovation and Application" pointed out: Accelerating supply chain innovation and building a modern supply chain has become an important part of deepening supply-side structural reform and building a modern economic system[3]. Therefore, the establishment of supply chain management majors has an important connection with national economic development.

## 2 THE IMPACT OF THE THEORETICAL SYSTEM OF EVOLUTIONARY ECONOMICS ON REGIONAL ECONOMIC DEVELOPMENT

Evolutionary economics is the main economic theory of modern Western economics. It was formed in the 1980s. In 1988, the European Association for Evolutionary Political Economics was founded in the United Kingdom. In 1991, the British magazine "Evolutionary Economics" was founded. After the 1990s, many schools of evolutionary economics emerged[4]. The research theory of evolutionary economics has been gradually applied to modern enterprise management, industrial technological change and other aspects, and has attracted more and more attention. In June 2004, Nanjing University established the "Evolutionary Economics Research Center", marking the beginning of evolutionary economics research in my country. Since then, more and more scholars have joined the research, and a theoretical school of evolutionary economics research with the characteristics of my country's market economy has initially formed[5]. Evolutionary economics is characterized by interpreting and studying innovation and integration issues existing in social and economic development from dynamically changing data and phenomena, using evolutionary economics theoretical research to guide economic and industrial integration innovation, and providing a reference theoretical basis for social and economic development.

The theory of evolutionary economics has the following theoretical research characteristics: dynamically changing data and dynamically changing economic phenomena. At the same time, these dynamically changing data and phenomena are used to continuously discover, research, analyze and explain social and economic industrial innovation and integration issues[6]. Its research value lies in shifting the original research focus from effective and balanced results to dynamic processes. With the development of the world economy and major adjustments to the economic structure, industrial innovation and industrial integration form the characteristics of new economic industries. When traditional industries merge with emerging industries and other industries, new business formats emerge one after another through innovation and integration of industrial chains and supply chains, thus driving the development of local and regional economic industries[7].

## **2.1 Analysis of the Innovative Integration Process Model of Industrial Chain and Supply Chain under Evolutionary Economics**

### ***2.1.1 Analysis of the relationship between evolutionary economics and industrial chain and supply chain innovation integration***

Society is constantly changing and developing, and is becoming more and more suitable for social and economic development. Evolutionary economics starts from the perspective of the limited laws of economic evolution and follows the thinking of biological evolution to study and analyze social and economic changes. Its research and analysis focus is on the organizational structure and organizational levels of social and economic organizations in the process of social change and development[8]. The integration of the industrial structure of industrial enterprises, from the perspective of social resource integration and innovation, how to better face the changing situation and risks, make more appropriate choices and combinations, discover the economic laws of the evolution and optimization of the social and economic structure, and guide and drive local Regional economic development, promoting the innovation and integration of local regional industrial chains and supply chains, and giving full play to the theoretical guidance of evolutionary economics. Local regional economies have certain industrial resource advantages and geographical location characteristics, and can take advantage of international and domestic economic development opportunities and national industrial policy support to form their own specific and different industrial foundations and industrial characteristics, and have formed a complex synthesis of local economic development system[9]. However, in the development process of local regional economy, it will definitely be restricted and affected by relevant factors from both inside and outside the local regional economic system, and they will interact with each other, and a certain fixed thinking mode will be formed among managers of local regional economic and industrial enterprises. When bottlenecks in the development of industrial enterprises appear, causing difficulties in the development of local and regional economic industrial enterprises, they are helpless and find it difficult to solve the dilemma. In this way, there are certain regular issues of continuous optimization and evolution of economic and industrial organizations and industrial structures among them, gradually forming a continuous optimization mechanism of local and regional economic industries and an interaction and transmission innovation mechanism between different industrial enterprises, influencing each other and influencing each other effect[10]. Based on this, evolutionary economics is how to use its theoretical methods of evolution, optimization, integration, and innovation to study and analyze the economic phenomena of the continuous development and evolution of local and regional economic and industrial enterprises, the optimization mechanism of local and regional economic and industrial industries, and the common laws of regional economic development and evolution. , and continuously enrich the modern economics theoretical system, thereby better guiding the integrated and innovative development of local regional economic industrial chains and supply chains.

Therefore, the integration innovation of local regional economic industrial chain and supply chain based on evolutionary economics is to use the theoretical methods of evolutionary economics to help local regional economic and industrial enterprises find suitable opportunities for integration and innovation, and solve the dilemma of local and regional economic and industrial enterprises. , explore a local regional economic industry enterprise integration innovation model, innovate the innovative integration mechanism of local regional economic industry chain and supply chain, which has played a certain guiding and demonstration role in the development of local regional economy.

## **2.2 Analysis of the Innovative Integration Process Model of Industrial Chain and Supply Chain under Evolutionary Economics**

Based on the comprehensive analysis of the integration and innovation process of local regional economic industrial chain and supply chain under the theory of evolutionary economics, it was found that there are three common new models of industrial innovation integration: industrial development process integration, industrial innovation integration method integration, and creative innovation integration hierarchical integration. , which provides a reference for exploring and solving the difficulties and problems encountered in the development of local regional economic and industrial industries, and provides an integrated innovation model based on evolution and optimization under evolutionary economics.

## **2.3 Model Characteristics of the Innovative Integration Process of Industrial Chain and Supply Chain under Evolutionary Economics**

In the socio-economic industrial structure, different industrial structures have their own industrial characteristics. Under the influence of the innovation and integration process of the industrial chain and supply chain, they are constantly changing. Finally, various elements of the socio-economic industry are optimized, forming the innovative integration of industrial chain and supply chain. model.

The degree and method of integration between local regional economic industry chains and related supply chains are different, resulting in uneven distribution of the degree of innovative integration of social economic industrial chains and supply chains, forming an innovative integration model of industrial chains and supply chains.

Therefore, the characteristics of local regional economic industrial chains and supply chains based on evolutionary economics are integration and innovation. Only by learning to proactively search for, appropriately select, optimize resources, seize opportunities, and continuously integrate and innovate under the ever-changing social and economic situation can local and regional economic and industrial enterprises develop sustainably and comprehensively improve their competitiveness and brand influence. It plays a leading and guiding role in the regional economy.

#### **2.4 Analysis of Economic Effects of Industrial Chain and Supply Chain Innovation Integration Process Model under Evolutionary Economics**

From the analysis of the economic effects of the industrial chain and supply chain innovation integration process model, the evolution from industrial enterprise integration to supply chain integration innovation is accompanied by three economic effects :

##### ***2.4.1 The economic "chain owner" leading effect of the innovative integration of industrial chain and supply chain***

The innovative integration of industrial chain and supply chain is a break from the established production methods, which can bring sufficient economic benefits to its own industrial enterprises. The new products of integrated industries and enterprises generated after the innovative integration of industrial chain and supply chain will be selected through the market selection mechanism. It can better meet the needs of consumers, form an industrial enterprise cluster effect, lead the integration and innovation of the local regional economic industrial chain and supply chain, and have the "chain master" enterprises of the local regional economic industrial chain and supply chain economy to form an industrial chain. The economic effects of integrating with supply chain innovation.

##### ***2.4.2 Demonstration effect of "chain group" of industrial enterprises through innovative integration of industrial chain and supply chain***

Faced with the changes in new situations and new market demands, enterprises within a certain local regional economic industry took the initiative to produce new integrated innovative products through communication, cooperation and integrated innovation with other industrial enterprises, meeting the needs of market consumers and bringing benefits to industrial enterprises. bring economic benefits and form a demonstration effect among local and regional economic and industrial enterprises. This will definitely trigger other industrial enterprises in the local regional economy to learn. In this way, the local regional economic industrial enterprises will be divided into demonstrators and imitators of the integration and innovation process of the industrial chain and supply chain, and the cycle will repeat. Huge changes have occurred in the products, technologies, and management structures of local and regional economic and industrial enterprises, driving the integration and innovation of local and regional economic and industrial industries, forming the "chain cluster" effect of local and regional economic industrial chains and supply chain economies, and providing a basis for the adjustment of local and regional economic and industrial structures. , further optimize the integration and innovation of industrial chain and supply chain, and promote the development of local regional economic and industrial structure to a higher level.

##### ***2.4.3 The "chain point" integration effect of industrial enterprises through innovative integration of industrial chain and supply chain***

In the process of integration and innovation of industrial chains and supply chains in local regional economies, it is difficult for the same industrial enterprises and different industrial enterprises to communicate and share information with each other, forming information islands. In order to meet the new needs of new markets in the new era, it is necessary to find local and regional economic and industrial enterprises that can develop faster and better, and form a consensus to embark on the road of integrated innovation and development together. With the support of national infrastructure and industrial policies, local and regional economic and industrial industries Industrial integration and innovation activities between enterprises and enterprises in different industries are constantly emerging. In this way, the nodes of innovation and integration of local regional economic industries and enterprises are opened up, forming a "chain point" integration phenomenon between the local regional economic industry chain and the supply chain economy, and producing the innovative integration effect of industrial chain and supply chain integration.

Therefore, based on the analysis of the industrial chain and supply chain innovation integration process model under evolutionary economics, it can be found that the industrial chain and supply chain innovation integration process model under evolutionary economics has the emergence of industrial development process integration, industrial innovation integration method integration and creativity. Innovation integration hierarchically integrates three new models of industrial innovation integration. Through comprehensive analysis of evolutionary economics and industrial chain and supply chain innovation integration relationships, process models, characteristics and economic effects, we can understand industrial chain and supply chain innovation under evolutionary economics. The integration process model will produce three economic effects: economic leadership effect, enterprise demonstration effect, and enterprise integration effect. It will continuously optimize the organizational structure and organizational levels of local and

regional economic and industrial enterprises, and explore the evolution rules of local and regional economic and industrial industries.

The search and research on the integration innovation model of industrial chain and supply chain based on evolutionary economics provides an effective application model that can be used for reference.

### 3 DATA ANALYSIS OF SUPPLY CHAIN MANAGEMENT MAJORS ESTABLISHED IN 25 UNIVERSITIES ACROSS THE COUNTRY

In the face of changes in the world economic situation and major adjustments to the national economic structure, especially since the State Council's "Guiding Opinions on Actively Promoting Supply Chain Innovation and Application" in 2017, the Ministry of Education added the supply chain management major to the catalog in 2017. For foreign majors, colleges and universities across the country have taken active actions to apply for supply chain management majors, which will be reviewed and approved by the Ministry of Education. According to statistics from the Purchasing and Supply Chain Professional Committee of the China Federation of Logistics and Purchasing, by July 2020, there were only 25 supply chain management schools in colleges and universities in my country (as shown in Table 1).

Table 1 List of supply chain management majors established in universities across the country

School Name	Filing year	School Name	Filing year	School Name	Filing year
Wuhan University	2017	Shan Dong University	2019	Xiamen Huaxia College	2019
Central University of Finance and Economics	2018	Southwestern University of Finance and Economics	2019	Jimei University Chengyi College	2019
Beijing University of Materials Science and Technology	2018	Dalian Maritime University	2019	Hunan Technology and Business University	2019
Baoding University	2018	Beijing Technology and Business University	2019	South China University of Technology Guangzhou College	2019
Yingkou Institute of Technology	2018	Beijing city college	2019	Chongqing University of Science and Technology	2019
Shanghai Maritime University	2018	Zhejiang Wanli University	2019	Chongqing University of Posts and Telecommunications Yitong College	2019
Xi'an Jiaotong-Liverpool University	2018	Anhui Normal University	2019	Chongqing Second Normal University	2019
Hefei University	2018	Bengbu University	2019		
Chengdu University of Information Science and Technology	2019	Henan University of Technology	2019		

From the analysis of the establishment time of the supply chain management major, there was 1 institution in 2017, 7 institutions in 2018, 17 institutions in 2019, and as of July 2020, there were 25 institutions nationwide. Hubei Province was the first to receive approval. From the analysis of the nature of universities offering supply chain management majors across the country, among the 25 universities: 19 are public universities, including 6 universities under the Ministry of Education 221; 1 Sino-foreign cooperative university; and 5 private universities. It can be found that when the Ministry of Education approved the setting up of supply chain management majors in colleges and universities, it fully took into account the demonstration and leading role of public colleges and universities, and also took into account the exploratory role of private colleges and universities. This provides a reference for the establishment of supply chain management majors in colleges and universities across the country in the future. Templates and experiences.

### 4 ANALYSIS OF THE REGIONAL ECONOMIC LAYOUT OF SUPPLY CHAIN MANAGEMENT MAJORS IN 25 UNIVERSITIES ACROSS THE COUNTRY

From the analysis of the regional distribution of supply chain management majors, 25 universities are distributed in the following provinces and cities. Among them, there are 8 in three municipalities, 4 in Beijing, 1 in Shanghai, and 3 in Chongqing; 17 in 12 provinces: 1 in Hubei, 1 in Hebei, 2 in Shandong, 1 in Liaoning, 1 in Jiangsu, and 3 in Anhui. 1 in Zhejiang, 2 in Fujian, 1 in Henan, 1 in Hunan, 1 in Guangdong, and 2 in Sichuan. From the analysis of the cities and economic regions where universities majoring in supply chain management are located, it can be concluded that 25 universities from 2017 to 2019 The city you are in is divided into three types. Among them, there are 8 in 3 municipalities: 4 in Beijing, 1 in Shanghai, and 3 in Chongqing; 8 in 7 provincial capital cities: 2 in Chengdu, 1 each in Wuhan, Hefei, Jinan, Zhengzhou, Changsha, and Guangzhou; other cities There are 9 out of 8: 2 in Xiamen, and 1 each in Baoding, Yingkou, Suzhou, Dalian, Ningbo, Wuhu, and Bengbu. These cities are my country's economic and

industrial concentration areas, with profound industrial, light industry, and agricultural foundations, superior industrial foundations, and economic strength. Most of them are located in the eastern region, the southern region, and the southwest region, close to the Bohai Bay, the Yangtze River Economic Belt, and the Yangtze River. The Delta City Group, the Minjiang Delta, and the Pearl River Delta have convenient transportation and are close to railway hubs, highway hubs, and port hubs. They have a superior geographical location near the river and the sea, providing these universities with supply chain management majors with good school-enterprise cooperation opportunities. Companies that provide students with good educational and teaching resources and professional training and internship opportunities have laid a solid foundation for the employment and entrepreneurship of supply chain management students.

From the analysis of the educational background of 25 universities with supply chain management majors, 20 of the 25 universities are public universities. These universities have a long history of running schools and are involved in petrochemical industry, machinery industry, agriculture, food processing, automobile manufacturing, marine transportation, meteorology, food, commercial circulation and logistics and other industries, it provides good professional teachers and professional training employment guarantee for the supply chain management professional education and teaching, and provides good enterprise employment guarantee for enterprises in these economically developed areas. Other universities across the country have played a leading role in running supply chain management majors. There are also 5 private colleges and universities among the 25 colleges and universities. Although their history of running schools cannot be compared with public colleges and universities, these private colleges and universities have flexible school-running mechanisms, are good at seizing opportunities, and have a certain influence among private colleges and universities with their distinctive majors. They have set a good example for other private colleges and universities. Private colleges and universities have made effective explorations in running the supply chain management major.

## **5 ANALYSIS ON THE CORRELATION BETWEEN SUPPLY CHAIN MANAGEMENT MAJOR AND REGIONAL ECONOMY UNDER THE NEW ECONOMY**

With the changes in economic globalization and corporate competition models and the implementation of the “One Belt, One Road” initiative, the Internet digital era has brought opportunities for the reshaping and optimization of economic industry chains, value chains, and supply chains. “Modern supply chains” are increasingly affected by the country and society. Attracting great attention from all walks of life, supply chain management services have become an emerging industry, and supply chain competitiveness has risen to national strategy.

In 2020, the Ministry of Education officially included the supply chain management major in the "Catalogue of Undergraduate Majors in General Colleges and Universities (2020 Edition)". It is a major under the management category, logistics management and engineering majors. The major code is 120604T, and the degree awarding category is Management, the duration of study is four years. This creates a rare opportunity for universities across the country to apply to set up supply chain management majors in the future, and it has become one of the new popular majors. In the past ten years, the logistics industry has developed rapidly, and industrial competition has entered the supply chain stage. The gap in scientific and technological talents in the supply chain field has reached more than one million.

### **5.1 World Trade Development and the Need for “New Infrastructure” in National Economic Construction**

With the development of economic globalization, companies in various countries have begun to pay attention to overseas markets. Among multinational companies, one of the most difficult problems to solve is the problem of supply chain. From suppliers to manufacturers, to distributors and consumers, each link may be carried out in different countries. If all links are comprehensively managed and seamlessly connected, supply chain management professionals can meet the needs of these international markets. talent needs.

The sudden COVID-19 epidemic has rapidly changed the global supply chain and strengthened its important role. The epidemic has accelerated the application of disruptive technologies in the supply chain. China has become an important center for global supply chain innovation and application, and new infrastructure has further improved the efficiency of information flow. The post-epidemic era is a great opportunity for the cultivation and development of supply chain management professionals. The importance of cultivating and using supply chain management professionals has become increasingly prominent.

Based on this, the transformation of the supply chain as an organizational method and business model is a new normal in the future economic and social development of China and the world. The deep integration of the supply chain with the Internet, the Internet of Things, big data, blockchain, and industrial finance, as well as the deep integration of chain and physical industries is an inevitable trend in the future. Supply chain is the foundation of China's economic transformation and development. Industrial supply chain and urban supply chain are the focus. National supply chain is fundamental, and it is China's global supply chain strategy. The supply chain management profession also emerged in response to the needs of the times.

### **5.2 Analysis of the Professional Integration Model of Local Regional Economy and Supply Chain Management**

Regional economy has certain uniqueness in my country and is an important part of my country's economic structure. In the future, the development of my country's regional economy will still be the main growth point of my country's

economy. From the analysis of the current trend of integrated development of regional economy and supply chain in my country, there are generally the following integration models of regional economy and supply chain: complete supply chain "chain owner" model, main supply chain "chain group" model, partial supply chain "chain" model "point" model and regional supply chain "emergency" model.

#### **5.2.1 Complete supply chain "chain master" model**

Each local regional economy can rely on its own regional economic advantages and location advantages to create a group of leading enterprises and advanced models with distinctive characteristics and advantages, influential industrial clusters, and advanced models through the implementation of the industrial chain leader system, and build a public-type The distribution center promotes the integration of the industrial chain and the supply chain, stabilizes the supply chain, extends the industrial chain, and enhances the value chain. Zhejiang Province and Jiangxi Province took the lead in pioneering the industry chain length system in the country, building a platform for local and regional economic development, and innovating a new model for the integrated development of local and regional economies and supply chains across the country.

#### **5.2.2 Main supply chain "chain group" model**

Give full play to the advantages of local regional industries and strengthen the industry with the help of transportation resource advantages and the country's preferential policies for local regional economic development, such as the "One Belt, One Road", "Yangtze River Delta City Group", "Yangtze River Economic Belt" and "Guangdong-Hong Kong-Macao Greater Bay Area" Infrastructure construction will promote the integration mechanism of the industrial chain and supply chain, use the development of industrial clusters with local influence to drive the development of other related industries, give priority to the layout of industrial information technology and platforms, and enhance the integration service capabilities of the industrial chain and supply chain.

#### **5.2.3 Some supply chain "chain point" models**

Give full play to the advantages of local material circulation and gathering resources, and rely on the location advantages of node cities with advantages in transportation in various places to open up fast channels for material circulation in node cities of the industrial chain and supply chain, implement efficient distribution in urban and rural areas, and rely on the national logistics hub node city pilot to vigorously Promote the construction of a three-level distribution network system of urban and rural distribution centers, distribution centers, and terminal service outlets, strengthen industrial standardization, improve cross-border e-commerce service capabilities, and form a regional economic industry and supply chain connectivity mechanism to assist local and regional economic development.

#### **5.2.4 Regional supply chain "emergency" model**

The sudden COVID-19 epidemic has rapidly changed the global supply chain and strengthened its important role. The epidemic has accelerated the application of disruptive technologies in the supply chain. A regional supply chain emergency model emerged. The post-epidemic era is a great opportunity for the cultivation and development of supply chain management professionals. The importance of cultivating and using supply chain management professionals has become even more prominent.

### **5.3 Analysis of the Integration of Regional Economy and Supply Chain Management Majors**

Jiangxi Province is located in the central region with a weak economic foundation and obvious differences compared with surrounding provinces. In recent years, the growth rate of the added value of Jiangxi Province's above-scale industries has continued to rank first in the country. The process of new industrialization has been accelerating and has entered the middle and late stages of industrialization. However, under the complex and severe economic situation at home and abroad, Jiangxi Province's industry is facing the dual pressures of stabilizing growth and improving quality, as well as the dual challenges of turning energy and adjusting structure. Currently, the construction of Jiangxi Province's economic and industrial supply chain system lags behind. According to data from the Jiangxi Provincial Department of Commerce's 2019 Jiangxi Provincial Logistics Industry Market Survey Report, most enterprises in Jiangxi Province have generally small business scales, insufficient investment in standardization construction, have not introduced advanced supply chain management concepts, and have little willingness to improve standardization. It seriously affects the growth of Jiangxi Province's economic output value and restricts the economic development of Jiangxi Province. At the same time, there are very few supply chain management talents who can meet the needs of enterprises, and the shortage of supply chain management talents is becoming more and more serious. The lack of suitable supply chain management talents is a problem faced by Chinese enterprises. To achieve high-quality leap-forward development of Jiangxi Province's industry, grasp the strategy of strengthening the province through industry, build a modern industrial system, and strengthen the training of supply chain management talents, it is imperative.

Jiangxi Province has unique geographical advantages. It is adjacent to the Yangtze River Economic Belt to the north, and is located in the extended economic belts of the Yangtze River Delta, Minjiang River Delta, Pearl River Delta, and economically developed urban agglomerations such as the Guangdong-Hong Kong-Macao Greater Bay Area. It has become the industrial and economic extension belt of these areas. Well connected with the "One Belt, One Road" initiative. In 2020, Jiangxi Province was awarded the National Inland Open Economic Pilot Zone, the first batch of "single window" pilot projects for international trade in inland coastal areas in the country, Nanchang became a national logistics hub city for business and trade services, and Jiujiang, Ji'an, and Ganzhou became national cross-border e-commerce companies. Import pilot cities.

To this end, on May 4, 2017, the Jiangxi Provincial People's Government issued the "Jiangxi Province "Thirteenth Five-Year Plan" Modern Logistics Industry Development Plan". It is proposed that by 2020, Jiangxi Province will basically establish a modern logistics service system with reasonable layout, advanced technology, green and efficient, and become an important regional logistics center for the "Belt and Road" and the Yangtze River Economic Belt. The added value of the logistics industry strives to reach 190 billion yuan, and the added value of the logistics industry accounts for about 7.3% of the regional GDP. The added value of the logistics industry generated by new logistics technologies, new models, and new formats based on the Internet accounts for the increase of the entire industry. About 40% of the value.

In April 2020, the Jiangxi Provincial People's Government issued the "Jiangxi Province Three-Year Action Plan to Promote High-Quality Development of Logistics and Promote the Formation of a Strong Domestic Market (2020-2022)". Efforts should be made to promote innovation in the logistics supply chain, and accelerate the transformation of large-scale commercial circulation enterprises into supply chain "chain owners" to form competitive advantages. Guide leading enterprises in characteristic and advantageous industries to use supply chain operation methods, integrate upstream and downstream small, medium and micro enterprises into the production and operation process, and strengthen resource integration and optimization capabilities through the logistics chain, capital chain, and technology chain; promote logistics "platform" supply chain enterprises to Provide "one-stop" services to small and medium-sized enterprises and freight forwarding entities; improve the intelligence level of the manufacturing supply chain; support supply chain enterprises in applying advanced technologies such as logistics big data and cloud computing to provide logistics big data services in the manufacturing field; encourage the development of Modern supply chain models such as virtual production and cloud manufacturing characterized by personalized customization, flexible production, and high resource sharing will enhance the value creation level of the entire logistics chain and promote the development of logistics industry clusters. Promote the development of 50 logistics industry clusters in the province, further optimize the layout of logistics industry clusters, and enhance the ability to serve the real economy.

In April 2020, the Jiangxi Provincial People's Government issued a document on the implementation of the industrial chain chief system. A total of 12 people, including the governor and deputy governor, personally served as 14 corresponding industrial chain chiefs. Its purpose is to stabilize the industrial chain supply chain, vigorously develop manufacturing, trade circulation, cultural tourism industry, biomedicine and other industries, extend the industrial chain, enhance the value chain, integrate the supply chain, promote the transformation and upgrading of the industrial chain, and provide Jiangxi supply chain innovation and Provide solid support for high-quality leap-forward development.

The Jiangxi Provincial People's Government takes advantage of the geographical advantages of Jiujiang City and Xiangtang Town to actively promote the integration and innovation of local regional economic industrial chains and supply chains to help Jiangxi's local regional economic development.

Jiujiang City is located in the northern part of Jiangxi Province, close to the Yangtze River. It has a 152-kilometer-long Yangtze River Economic Belt. It has very rich corporate resources and unique transportation, industrial and commercial circulation advantages. With the advantage of Jiujiang Port, the first shipping terminal in Jiangxi Province, The railway, highway, water shipping, and civil aviation transportation hub nodes around the Yangtze River Economic Belt have formed a new pattern of integrated development of the industrial chain and supply chain with north-south docking, joint development, and win-win cooperation with Nanchang Port.

In May 2020, Jiujiang City received approval from the State Council to establish a national cross-border e-commerce comprehensive pilot zone, becoming the first cross-border e-commerce zone in Jiangxi Province focusing on bonded stocking and cross-border supply chain services. Relying on the support of national industrial policies, it has Cross-border e-commerce creates a complete industrial chain and ecosystem. Jiujiang City takes the opportunity of building the Yangtze River Economic Belt Green Development Demonstration Zone to focus on the integration and innovation of the industrial chain and supply chain, carefully cultivate new materials, new energy, electronic appliances, biomedicine, and green food as emerging industries, and build a modern industrial system. Promote the growth of foreign trade, promote the economic development of Jiujiang, and promote the active participation of cross-border e-commerce service companies, foreign trade companies, industrial companies, and small and medium-sized online merchants. At the same time, expand exports to promote transformation, and expand imports to promote consumption. It will attract more e-commerce companies and logistics companies to settle in Jiangxi, thereby providing more jobs for Jiangxi people and becoming a demonstration area for the integration and innovation of industrial chain and supply chain in Jiangxi Province.

Xiangtang Town in Nanchang is located in the main artery of China's railway network. Xiangtang marshalling station is the largest railway freight marshalling station south of the Yangtze River. It is an important transfer point and major channel for the material circulation of industrial enterprises in Jiangxi Province. In recent years, the Jiangxi Provincial Government has focused on building Xiangtang Logistics Park, focusing on the construction of commercial logistics parks, and striving to build Xiangtang into a national-level railway-highway hub comprehensive logistics park. With the opening of China-Europe freight trains, three international freight trains from Xiangtang to Rotterdam, Hanoi, and Moscow continue to write the glory of the Silk Road, and Xiangtang to Shenzhen Yantian Port, Ningbo Beilun Port, Fujian Jianguan Port, Xiamen Port, etc. Four rail-sea intermodal foreign trade trains bring together resources from all over the world. With the core of "building an international logistics port and building a modern logistics city", we will accelerate the construction of large hubs, large logistics, large industries, and large commerce, and an "inland waterless port" is quietly taking shape.

At present, China Merchants Logistics, GLP Logistics, Baowan Logistics, Chuanhua Logistics, JD.com, Tmall, No. 1 Store, and Best Logistics have settled in Xiangtang; coupled with the extension of Nanchang Metro Line 3 and the construction of Nanchang South Station, It will greatly attract more advantageous industries and enterprises to settle in, form a siphon effect on Xiangtang's trade and logistics industry, and enhance the aggregation effect of Xiangtang's logistics industry cluster.

Jiujiang National Cross-border E-Commerce Comprehensive Pilot Zone and Xiangtang Logistics Park will have more and more demands for business logistics talents in the future, and the level of talent demand will also become higher and higher.

Although the integration and innovation of industrial chains and supply chain industries has become a trend in local regional economic development across the country, the "supply chain management" major offered by universities across the country is far from meeting the demand for supply chain management talents in regional economies across the country. Currently, there are 2,956 universities across the country, including 1,278 undergraduates, and only 25 universities offer the "supply chain management" major. Currently, there are 45 undergraduate colleges and universities in Jiangxi Province, including 24 public colleges and 21 private colleges and universities, which do not offer the "supply chain management" major. This is due to the rapid development of Jiangxi's regional economy and industrial economy, which has a great demand for supply chain management talents. There is a big gap between the national regional economic and industrial layout and development. Therefore, the establishment of a supply chain management major will be of great help to the national and local regional economic development. The space for innovation and cooperation in the integration of industrial chain and supply chain will become more and more big.

#### **5.4 Analysis Conclusion on the Correlation between Supply Chain Management Major and Regional Economy under the New Economy**

Based on this, the transformation of the supply chain as an organizational method and business model is a new normal in the future economic and social development of China and the world. The deep integration of the supply chain with the Internet, the Internet of Things, big data, blockchain, and industrial finance, as well as the supply The deep integration of chain and physical industries is an inevitable trend in the future. Supply chain is the foundation of China's economic transformation and development. Industrial supply chain and urban supply chain are the focus. National supply chain is fundamental, and it is China's global supply chain strategy.

The regional economy under the new economy needs more supply chain management professionals with comprehensive knowledge systems to assist the development of local and regional economic industries, transform and upgrade local and regional economic and industrial enterprises, enhance the core competitiveness of local and regional economic and industrial enterprises, and supply Chain management professionals will give full play to more professional advantages, but will promote the integration and innovation of local universities and local regional economic and industrial development, give greater play to the role of local universities in actively serving local regional economic development, and form local regional economic industry chains and supplies. The integration of the supply chain and the virtuous cycle of the local regional economic industrial chain and the construction of supply chain management majors in local universities.

Relying on its own resource advantages and innovative features, the supply chain can be connected with other different industries to form different industrial supply chains. When the supply chain and the industrial chain are connected, due to the differences in industrial environment and industrial characteristics, the supply chain will have opportunities for optimization and integration, thus forming different industrial supply chain models that can adapt to the economic development of different regions. Promote supply chain innovation, promote the transformation and upgrading of local regional economies, expand and extend the integrated development of primary, secondary and tertiary industries and supply chains, reduce the cost of supply chain operation links, play a role in the development of regional economy, and provide professional supply chain management products The integration of teaching and the employment and entrepreneurship of professional students creates greater room for development.

#### **6 RECOMMENDED MEASURES**

In 2020, the Ministry of Education included the "Supply Chain Management" major in the Ministry of Education's undergraduate major catalog, which means that the approval authority for the establishment of the "Supply Chain Management" major is also delegated from the Ministry of Education to the education departments of each province, city, and autonomous region for approval. In the future, with the advancement of the country's "new infrastructure", the enrollment of majors related to the supply chain is booming, and there will be a climax of applications for the "supply chain management" major. Recommendations for this are as follows.

(1) When the education departments of various provinces, municipalities and autonomous regions approve the establishment of the "supply chain management" major, they need to fully consider the policies and location advantages of the country's "new infrastructure", "one belt and one road" and "national logistics hub node cities", and focus on supporting the central region. Prioritizing the establishment of colleges and universities in the northwest and northeastern regions can not only avoid a swarm of establishments, but also give priority to the development of the local economy by taking advantage of local regional economic and industrial advantages.



(2) When approving the establishment of the "Supply Chain Management" major, the advantages of public universities must be fully considered, and there must be no bias against the establishment of majors in private universities. Certain policies should be given to private universities based on the principle of overall planning and focused support. Support, give full play to the supplementary role of private colleges and universities to higher education, and also activate the role of private colleges and universities in supporting local economic construction, forming a virtuous cycle.

(3) When universities in various provinces, municipalities and autonomous regions apply for "supply chain management", they must carefully analyze national industrial policies, seize the good opportunities for local and regional economic development, and combine the advantages of each university's own professional education and teaching resources with its geographical location advantages. , connect with local and regional economic industries, form the unique advantages of "supply chain management" majors in its own colleges and universities, avoid the homogeneity of professional talent training, and give full play to the function of local colleges and universities to actively serve local economic construction. "Unity of knowledge and action, industry, academia, research and application".

## COMPETING INTERESTS

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

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# RESEARCH ON EMERGENCY LOGISTICS OPERATION MODE AND OPTIMIZATION UNDER EMERGENCIES

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**Abstract:** Public health emergencies often bring huge losses and damage to life and property, and emergency logistics plays a pivotal role in ensuring the timely supply of materials. In the face of major public health events, China's emergency logistics still shows a series of problems, such as the information of material transport is not correct, the transparency is not high, and the capacity is not enough[1]. In view of these problems, it is proposed to establish a more efficient emergency logistics operation mode to promote the construction of China's emergency logistics, so as to better cope with sudden social and public crisis events.

**Keywords:** Emergency logistics; Block chain; Epidemic prevention and control; Smart logistics

## 1 INTRODUCTION

### 1.1 Background and Significance of the Research

At the beginning of 2020, in the face of the sudden outbreak of new coronary pneumonia, China reacted swiftly, taking measures such as isolation, "sealing off the city" and delaying the resumption of work, effectively stopping the large-scale spread of the epidemic. General Secretary Xi Jinping emphasized in the 12th meeting of the Central Committee for Deepening Reform that "we should improve the unified emergency material security system, make emergency material security an important part of the construction of the national emergency management system, and improve the relevant working mechanisms and emergency plans as soon as possible in accordance with the principles of centralized management, unified allocation, service in times of peace, emergency at times of disaster, combination of collection and storage, and economy and efficiency". At the same time, the meeting also proposed that "we should encourage the use of big data, artificial intelligence, cloud computing and other data technology to better play a supporting role in the epidemic monitoring and analysis, virus traceability, prevention, control and treatment, resource deployment and other aspects." This provides a clear direction for the construction and development of emergency logistics.

In the fight against the epidemic, especially when the city was "closed", the delivery of fresh fruits and vegetables, masks, alcohol and other daily living materials and medical supplies posed a great challenge to the traditional material transport system, but there were still problems such as incomplete development and slow development[4]. According to the data (see Figure 3), after mid-March, Shanghai's truckload traffic index showed a precipitous drop, and poor logistics naturally led to a lack of supplies[12]. Residents are unable to go out or buy their own supplies online, relying more on emergency supplies from government departments and donations from outside the city[10]. At the same time logistics vehicles face layers of government and respective closures on motorways, and operating revenues have fallen sharply (see Figure 1). There are too many checkpoints on the highway to prevent epidemics, many highway exits are closed, there are passes that don't allow you to get off the highway, the service area doesn't allow you to stop, and you can't unload your goods at the place. Even after the successive opening of express transport, a number of companies distribution shutdown, a number of headline companies have shown negative growth in shareholder profits (see Figure 2), and many couriers who were isolated in the community can not deliver packages. The last kilometre of distribution has become a problem[3].

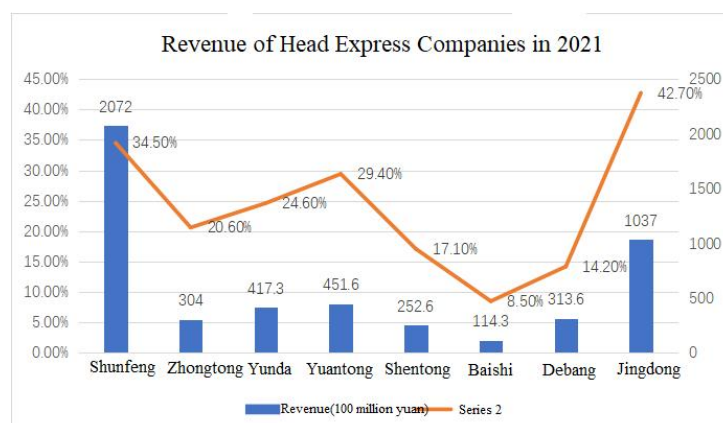
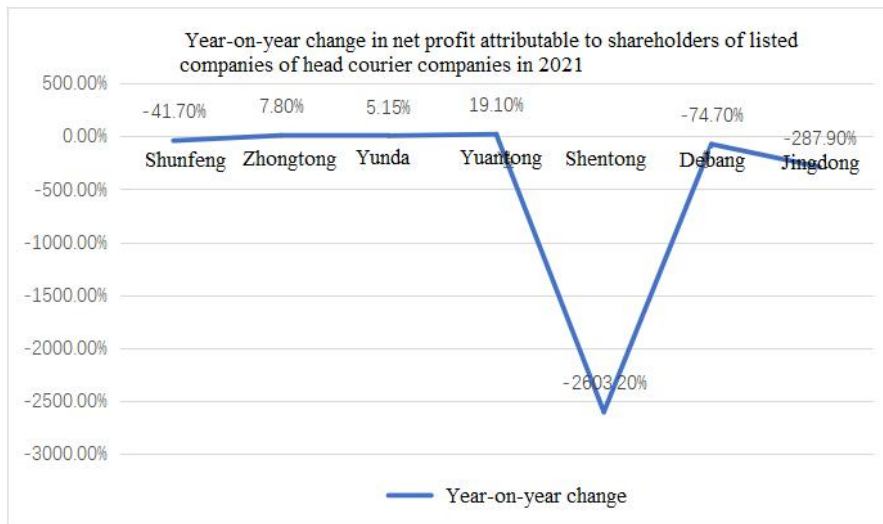
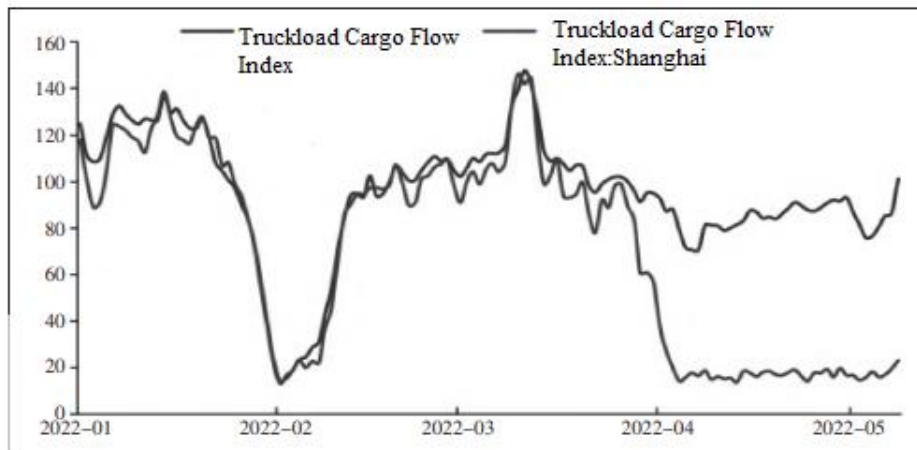


Figure 1 Revenue of Head Express Companies in 2021



**Figure 2** Year-on-year change in net profit attributable to shareholders of listed companies of head courier companies in 2021



**Figure 3** Comparison of the whole truck freight traffic index during the epidemic in Shanghai and the whole country

**1.2 Research Purpose**

In the face of the future epidemic normalized prevention and control measures and the urgent demand of the society for emergency logistics, the establishment of a perfect emergency logistics system has become an important guarantee for the normal operation of the society, and it has a pivotal role in responding to public emergencies[2]. In recent years, the concept of block chain technology has gradually become popular, and its decentralization, smart contracts, tamper ability, peer-to-peer transmission and other technological superiority have an important value for the construction of China's emergency logistics system.

**2 PROBLEMS OF THE CURRENT EMERGENCY LOGISTICS SYSTEM**

Building an emergency logistics system is an important measure for a country to respond to emergencies. Since the occurrence of the new crown pneumonia epidemic, people all over the country have been donating money and goods, the government has also sent a large number of human, material and financial resources to the serious areas of the epidemic. Such intensive emergency logistics distribution has brought great challenges to China's emergency logistics system, and also exposed the shortcomings of the imperfect and incomplete domestic emergency logistics system.

**2.1 Higher Cost of Emergency Logistics**

Due to the high efficiency of emergency logistics, high-quality special needs, its cost is relatively high. At the same time, emergencies are generally sudden and unpredictable. When the emergency logistics system is not perfect, the rush to deal with the transportation of a large number of emergency materials will increase decision-making errors and work errors, thus increasing the cost of emergency logistics. In addition, the quality of materials and some force majeure factors are also one of the reasons for the high cost of emergency logistics.

**2.2 Imperfect Emergency Logistics Operation Mechanism**

### **2.2.1 Emergency response is too passive**

In the face of the epidemic surge in material transport demand, the emergency response system is too passive. Emergency logistics organizations in the event of emergencies are mostly set up on temporarily, i.e. emergencies occur first, and then emergency logistics preparations are made. This kind of emergency logistics organization has relatively little cooperation and organizational experience, and lacks co-ordination when responding to emergencies, which leads to low efficiency and quality of emergency logistics.

### **2.2.2 Lower efficiency of emergency logistics**

Previously, China's emergency logistics system lacked a special organizational system, and the government and third-party enterprises have insufficient information about the demand side and the supply side of the materials, and the prediction and early warning of emergencies and coordination capabilities need to be improved, resulting in a long response time and low efficiency of emergency logistics, which is not conducive to a rapid response and an efficient and high-quality response to future public emergencies.

## **2.3 Existence of Information Asymmetry**

### **2.3.1 Information asymmetry between supply and demand sides**

China's emergency logistics system lacks information channels connecting supply and demand, resulting in asymmetric information, unclear demand and directionless supply[11]. This causes a large-scale waste of resources, but also leaves the demand for emergency supplies in areas with serious epidemics unmet, thus greatly reducing the efficiency of the fight against epidemics. In the long run, the information asymmetry between supply and demand sides greatly impedes the development of emergency logistics in China.

### **2.3.2 Information asymmetry within the emergency logistics system and the society at large**

Ensuring the openness and transparency of logistics information is one of the important measures to maintain the operation of emergency logistics system[5]. The information asymmetry between the emergency logistics system and the public mainly points to the phenomenon of opacity of emergency logistics information, including lagging material information, ambiguous direction of emergency materials, and unclear progress of material transport[7].

## **2.4 Inadequate Material Management Organization**

In the process of fighting against the new coronary pneumonia epidemic, the whole country is actively donating money and materials to make its own contribution to the prevention and control of the epidemic. However, a large number of emergency materials in the management is not satisfactory. Insufficient human resources for material management and imperfect working mechanism have led to repeated problems such as incomplete material information and lagging material distribution, which is also a shortcoming of China's emergency logistics system. At the same time, due to the lack of logistics information sharing system, the direction of the donated materials, the transparency of the emergency logistics process, and the efficiency of material information disclosure have not been reflected[6]. In addition, due to the lack of large-scale material storage centers, it is easy to cause temporary shortages of emergency materials.

## **2.5 Lack of Standardization and Supervision of Emergency Material Management**

At present, China has built a basic emergency logistics legal protection system, but there are still low degree of standardization, unclear responsibility of the main body of logistics management, government compensation and subsidies are not timely and other problems. Emergency logistics system construction lacks the corresponding support, norms and supervision.

## **3 Feasibility analysis of emergency system model combining block chain technology and third-party logistics**

### **3.1 Block Chain Technology has a High Degree of Compatibility with Emergency Logistics**

Block chain has the characteristics of decentralization, non-tampering, smart contracts, peer-to-peer transmission, etc., which are closely related to the needs of logistics system construction[9]. Block chain technology has a high degree of compatibility with the information management of emergency supplies in the epidemic, which is mainly reflected in the decentralization that makes the supply organizational structure compatible; smart contract meets the demand for efficient matching of information and coordinated deployment of supplies; sharing mechanism solves the problem of information asymmetry (see Figure 5); distributed ledger, consensus authentication, timestamps and other technologies not only provide completeness and security for the emergency logistics but also provide a means of information disclosure and guarantee of information openness and transparency in emergency logistics (see Figure 4). To a certain extent, this proves that block chain technology is highly compatible with the demand for high efficiency and high quality of emergency logistics system, and it is the right choice to apply block chain technology to the construction of emergency logistics system, which is conducive to the construction of China's emergency logistics system.

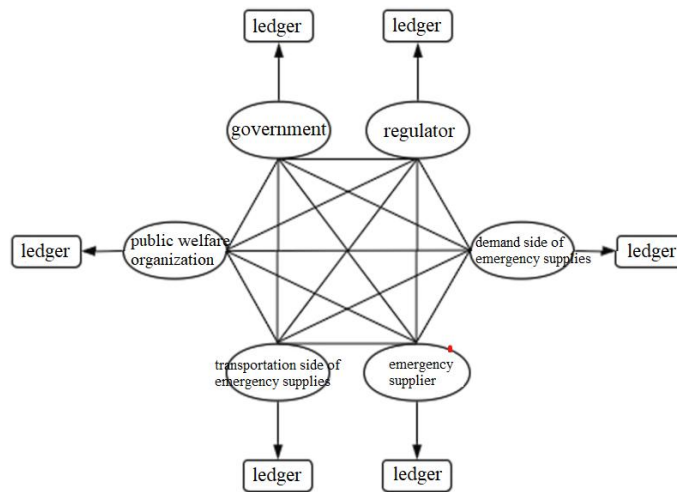


Figure 4 Bookkeeping network of distributed ledger

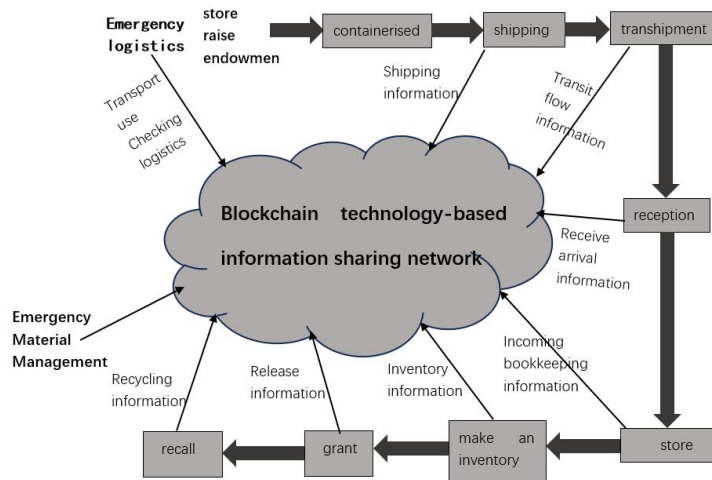


Figure 5 Emergency logistics model based on block chain technology

### 3.2 Third-Party Logistics Involved in Emergency Logistics System Construction Can Reduce the Cost of Emergency Logistics, Improve Logistics Efficiency

In recent years, China's logistics industry has been developing steadily, the scale is expanding, the total market continues to increase. Cost reduction and efficiency increase has become a major trend in the development of the logistics industry. Compared with the traditional logistics, third-party logistics operating costs and specialisation level is more advantageous, more in line with the trend of development of modern logistics industry. Therefore, the third-party logistics enterprises into the emergency logistics system construction can greatly reduce logistics costs, improve logistics efficiency, which also meets the demand for high efficiency and high quality of emergency logistics.

### 3.3 The Government-Enterprise Co-Operation Model has Certain Superiority

The government-enterprise cooperation in the construction of emergency logistics system means that the government provides financial subsidies and emergency data support, and conducts public-private partnership or implements positive industrial policies for enterprises, and the third-party logistics enterprises are responsible for the concrete implementation of emergency logistics. The superiority of this model lies in the following: on the one hand, the cooperation between the government and the third-party logistics enterprises can reduce the government's capital investment in the construction of the system, make reasonable use of the resources and services of the third-party logistics enterprises, and integrate the logistics enterprises into the construction of the emergency response system by means of the government's subsidy; on the other hand, the mode of cooperation between the government and the third-party logistics enterprises can promote the interaction of the government and third-party logistics enterprises in terms of resources and information, promoting the third-party enterprise's own development. In the long run, the establishment of third-party logistics emergency response system can promote the win-win situation for the government and enterprises, and at the same time, it can also guarantee the smooth operation of the emergency logistics system when an emergency occurs, so as to protect the people's life and social stability[8].

## COMPETING INTERESTS

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

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# STUDY ON THE IMPACT OF DIGITAL ECONOMY ON RURAL

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**Abstract:** Rural revitalization is a major and challenging topic in national economic development. With the arrival and popularization of the digital economy era, the impact of the digital economy on rural revitalization has become increasingly significant. As a marginal region in China, Xinjiang faces problems such as inconvenient transportation, lack of educational resources, and imperfect security facilities, and rural revitalization has become a nationally important challenge, therefore, this paper argues that it is of great value to study rural revitalization in Xinjiang. Given to the fact that the concept of big data in China was born in 2016, this study focuses on rural revitalization in the era of digital economy, with Xinjiang as the target. The model is constructed using data from 2016-2019 and analyzed using the coupled scheduling model, the level of digital economy and the level of rural revitalization, with special emphasis on the relationship between digital economy and rural revitalization. Some factors for the coordinated development of digital economy and rural revitalization are revealed through the coupling level and obstacle model. The results of the study show that the digital economy in Xinjiang shows a steady growth trend, and the coordinated development of rural revitalization and digital economy is generally on the rise, showing a good development prospect.

**Keywords:** Digital economy; Rural revitalization, Regional heterogeneity; Coupled coordination degree model; Barrier model

## 1 INTRODUCTION

With the progress of information technology and the widespread popularization of mobile Internet, digital information has become an important factor in production and daily life. According to relevant research, in 2022, the scale of China's digital economy will have reached 50.2 trillion yuan, accounting for 41.5% of GDP. With the deep development of the new round of science and technology, digital transformation has become a trend of economic development and is advancing globally. The transformation and upgrading of traditional industries towards intelligence, greening and integration has accelerated. New industries and new modes are flourishing, and the way of production and life is profoundly changing. Since the 18th CPC National Congress, China has taken the improvement of the digital economy as a national strategy, introduced a series of major policies, and comprehensively promoted the construction of digital China. By the end of 2023, China's gross domestic product (GDP) reached 56.1 trillion yuan, a nominal increase of 11.75% over the previous year. It accounts for 39.8% of GDP. In addition, digital economy, as a new form of economic and social development, is an important driving force to stimulate the endogenous development power of rural areas, which can tap the potential of green development in rural areas, promote the transformation and modernization of rural industries, and improve the level of agricultural and rural modernization.

In 2021, the No. 1 document of the central government explicitly proposed to comprehensively promote rural revitalization, implement the digital rural construction project, and accelerate rural modernization. 2022 "Digital Rural" Development Action Plan (2022-2025) pointed out the strategic significance of the digital economy in promoting urban-rural integration, assisting in the comprehensive revitalization of rural areas, promoting common prosperity, and solving the problem of balanced development. prosperity, and solving the problem of unbalanced development. These policies and documents reflect the potential and importance of digital economy for rural revitalization, and indicate that the research in this paper has theoretical and practical significance. It is well known that the development of digital technology facilitates the interaction between DEL and Rural Revitalization Level (RRL) for economic prosperity. In the face of the challenge of economic recovery after the New Crown Pneumonia pandemic, it is important to explore the evolution of the coupling coordination degree (CCD) between DEL and RRL, which has become a hot topic of academic attention.

Digital economy has been a hot topic in academia. Tapscott first proposed the concept of digital economy in the 1990s, and he described the digital economy but did not give a clear definition. In 2016, the G20 Initiative on Development and Cooperation in the Digital Economy explicitly pointed out that the digital economy is a digital knowledge and information as inputs, supported by information networks, with a series of economic activities with the effective use of information and communication technology as the driving force to improve efficiency and optimize economic structure. Currently, the research hotspots in the field of digital economy focus on the three phrases of "cloud computing, big data, and artificial intelligence", which involve the fields of employment, environment, productivity, and economic development. The research perspectives are complex and wide-ranging.



The CCD model is an analytical tool for evaluating and analyzing the interrelationships among different elements. Fu et al used it to analyze the spatial and temporal evolution characteristics of DEL and ecological environmental level (EEL) in China. They found that the CCD between DEL and EEL is well developed and the level has improved. Li et al used a composite synergy model to evaluate the level of coordination between DEL and logistics industry. Through the analysis, it was found that the level of their coordination has improved. However, the synergistic effect needs to be further strengthened [1]. Wang et al. discussed the relationship between DEL and urban low-carbon economic transformation and found that there is a u-shaped relationship between the two. Zhang et al examined the impact of DEL on the green economy using the SBM-GML model [2].

In recent years, there has been extensive academic interest in rural development, with some scholars taking a qualitative approach to explore the relationship between DEL and RRL. For example, Katara argues that the integration of information and communication technology (ICT) into smart village construction can improve farmers' living standards and promote the use of mobile technology to make e-government services more accessible to rural residents. Sutherland argues that Internet carrier innovations have changed rural consumption patterns, and Young argues that the digital economy can help rural residents to improve their living standards by constructing a "physical world" and a "digital world". Young believes that the digital economy realizes the comprehensive development of rural areas by constructing the virtual space of the "physical world" and the "digital world" and empowering the application scenarios of agricultural production, rural distribution, social governance, lifestyle, cultural concepts, and so on [3].

Mossberger argued that the increasing popularity of digital technology in economically backward countries creates educational and economic opportunities, and that information technology can break down barriers to socio-economic activities and reduce poverty [4]. Zhu and Shang argued that information technology can increase total factor productivity in agriculture, and that digital technology can change the way of agricultural development [5]. Zhao and Ding found that digitization can improve the agricultural quality and competitiveness, optimize rural production, living and ecological space, and improve the integrated urban-rural development system and policy system [4]. Feng and Zhang point out that DEL can promote rural infrastructure construction, empower digital agriculture and new rural business, promote effective governance, and provide further impetus for industrial upgrading [6].

Based on the existing academic research, this paper constructs a comprehensive, measurable and evaluable indicator system with the spatial scale of 14 Xinjiang prefectures and cities in 2016 - 2019. The entropy weight method and CCD model are used to objectively and scientifically reflect the development of DEL and RRL, and the trend of CCD changes. Meanwhile, the obstacle factors in the process of coupling coordination were analyzed by using the obstacle degree model. It is hoped that this study can enrich the research content in the field of digital economy and fill the gap between DEL and RRL in regional research. Power.

## 2 STATUS AND TRENDS OF DIGITAL RURAL DEVELOPMENT IN CHINA

### 2.1 Current Status of Research on Rural Industrial Revitalization

Research on rural industrial revitalization mainly focuses on two aspects: First, industrial integration and development. Rosenberg and Yoffie believe that industrial integration and development is not only an important research direction in industrial economics and information economics, but also has become a mainstream industrial form with the development of society. Jiang Changyun and Guo Jun, among others, believe that the fundamental purpose of integrated development is to give full play to the multifunctionality of agriculture, enhance the added value of agriculture, stimulate the endogenous motivation of farmers, and realize better production efficiency and economic benefits. The second is the high-quality development of agriculture and rural areas. The definition of the connotation of China's rural industrial revitalization stems from a profound understanding of the high-quality development of agriculture and rural areas, from an economic development model that better meets the growing practical needs of the people, and from the full embodiment of the Five Development Concepts. Emphasizing the coordinated development of multiple parties, it should involve multiple perspectives such as economic, social, ecological environment, national, and opening up to the outside world. Efficient, stable growth and innovation-driven development are realized from multiple aspects such as supply and demand, input and output, and income distribution. For the revitalization of rural industry, some literature suggests that it should be realized from multiple dimensions such as agricultural production and management system. It is an organic combination of rural ecology, culture, governance, agricultural production and farmers' life, and should be consistent with the overall goal of rural revitalization.

### 2.2 Current State of Research on the Digital Economy

One is from a conceptual perspective. Don Tapscott first introduced the concept of digital economy, stating that the digital economy is a new type of economic relationship that emerged after the advent of Internet technology. Institutions such as USDC (1999), USBC (2001), DBCDE (2013), and OECD (2016) define the digital economy as the evolving Internet and new technologies such as big data, and the economic and social activities derived from them. Second, in terms of scope, the core component is the digital sector itself. In a narrow sense, it refers to new business models created through the digital economy, such as the platform economy, e-commerce, etc., in a broad sense, it includes all digitalized economic activities, such as precision agriculture, digital media, digital transactions, etc. Third, in terms of



the composition of the digital economy, digital infrastructure is the fundamental support of the digital economy, and digital industrialization is steadily advancing as a pillar and leading industry. Among them, the digitization of agriculture is a prominent shortcoming in the development of the digital economy.

### 2.3 Current Status of Research on the Digital Economy for Agricultural and Rural Development

Pilat and Zheng Shilin concluded that informatization has a contributing effect on productivity improvement. Focusing on the field of agriculture, the findings of research on the impact of informatization on agricultural total factor productivity include: First, informatization has a significant contribution to agricultural total factor productivity, second, the effect is not significant, and third, there is a nonlinear or heterogeneous effect. Due to the fact that agricultural production itself is characterized by geographical, cyclical, seasonal and low elasticity of demand for agricultural products, farmers lack original capital accumulation, entrepreneurial talent, data information and other factors of production, which makes the development of the agricultural sector lag behind the urban sector for a long time. Meanwhile, problems such as information asymmetry, financial exclusion and financial threshold effects, insufficient rural infrastructures, and mismatches between the supply of and demand for financial resources and services have greatly constrained agricultural development. The advantages of the digital economy, such as renewability, non-competitiveness, inclusiveness and non-exclusiveness, can empower and enhance other factors of production through integration. The integration and development of the digital economy with the agricultural and rural economy can reduce information asymmetry, expand the scale effect of agricultural production, optimize the factor flow channels, effectively improve the efficiency of resource utilization, increase farmers' income and well-being, and promote the transformation and upgrading of agriculture and rural modernization.

### 2.4 Key Issues of Existing Research

Scholars at home and abroad have conducted some research on the empowerment of the digital economy on rural industries, and the research results cover different areas. There are summarized that previous studies have provided valuable insights into the digital economy and rural economy. However, there are few direct studies on the impact of digital economy on rural revitalization. In addition, previous studies have mainly used normative approaches, focusing on concepts and policy paths, and lack empirical studies. The quantitative impact of the digital economy on rural revitalization needs to be further explored.

## 3 BASIC CONCEPTS OF THE DIGITAL ECONOMY EVALUATION INDICATOR SYSTEM

The core concept of constructing a digital economy development evaluation index system is to vigorously promote digital industrialization and industrial digital integration development based on the digital governance environment and investment in digital economy infrastructure. At present, there are mainly the following types of indicators to measure the level of China's digital economy development: First, the digital city development index provided by Tencent and the global digital economy index provided by Ali Research Institute, Second, the index system is reconstructed based on the research framework of CITIC Tong Research Institute, Third, the coefficient of efficiency of the digital economy is adopted as a measurement variable. Indicators of different dimensions of digital economic development contain useful information about digital economic development, and considering only one or a certain dimension of indicators will lead to a one-sided understanding of digital economic development. Therefore, this paper mainly uses the following four types of indicators:

- (1) Digital economy infrastructure indicators. The digital economy is an economic form in which new digital technologies are widely applied, and the prerequisite for the application of digital technologies is a sound digital economy infrastructure. For example, there are indicators that show how long fiber optic cables are and how many cell phone base stations there are. There are also indicators showing how many Internet broadband access ports there are and how many Internet users there are.
- (2) Industrial digitization indicators. Industrial digitization improves output and efficiency through the integration and penetration of ICT products and services in other areas, especially in the three major industries. This paper uses indicators such as digital financial inclusion index, enterprise informatization level, number of express delivery operations, and e-commerce sales to measure this.
- (3) Digital governance indicators. Digital governance is an important guarantee for the healthy and orderly development of the digital economy, covering multiple levels such as government, policy, industry, innovation, property rights, and corporate governance. The indicators selected in this paper include the number of years of education per capita, the intensity of R&D investment, the number of digital economy enterprises, the total number of technology contract transactions, the number of patent applications, the number of licensing applications, and the number of government websites (the level of digital government) to measure the level of digital governance.
- (4) Digital industrialization indicators. Digital industrialization refers to the added value of the information industry characterized by digital technology, including digital technological innovation and digital industrial production, which mainly includes the electronic information manufacturing industry, the information and communication industry, the software service industry and the Internet-related industry. This paper adopts the indicators of digital industry

employees, digital industry gross industrial output value, telecommunication business volume and software industry revenue to measure the digital industrialization indicators.

#### 4 EMPIRICAL RESEARCH

Considering the availability and authenticity of the data, this paper selects the panel data of 14 Xinjiang municipalities from 2013 - 2019 for the study. The digital financial inclusion index is from the Digital Finance Research Center of Peking University. Other data are from Xinjiang Statistical Yearbook, Economic Forecasting System, China Rural Statistical Yearbook and statistical bulletins of 14 Xinjiang prefectures (cities). For some missing data, trend extrapolation forecasting method was used to define their values.

##### 4.1 Research Methodology

Before exploring CCD, the respective levels of development need to be measured. In order to ensure the objectivity and accuracy of the results, the entropy weighting method is used in this paper. This method determines the weights according to the degree of change in the value of each indicator. It is an objective weighting method that avoids the influence of human factors. The specific steps are as follows:

###### 4.1.1 Data balancing

Data balancing is very important in research to avoid numerical problems and balance the contribution of various features.

$$V_{ij} = r_{ij} + 0.1 = m \times \frac{X_{ij} - \min(X_{ij})}{\max(X_{ij}) - \min(X_{ij})} \quad (1)$$

$$m = \begin{cases} 1 & \text{If the indicator has a positive impact} \\ 0 & \text{If the indicator has a negative impact} \end{cases} \quad (2)$$

(1) where  $r_{ij}$  represents the standardized data,  $X_{ij}$  is the original value of item  $j$  in year  $i$ .

###### 4.1.2 Entropy calculation and weight calculation

$$p_{ij} = \frac{V_{ij}}{\sum_{i=1}^n V_{ij}} \quad (3)$$

(3) where  $p_{ij}$  represents the share of the  $j$ th indicator in year  $i$ ,  $V_{ij}$  is the transformed data in equation (3).

$$H_j = \frac{1}{\ln n} \sum_{i=1}^n p_{ij} \ln p_{ij} \quad (4)$$

(4) where  $H_j$  is the entropy value of the  $j$ th indicator.

$$W_j = \frac{d_j}{\sum_{j=1}^n d_j} = \frac{1-H_j}{\sum_{j=1}^n (1-H_j)} \quad (5)$$

(5) where  $d_j$  represents the different coefficients of the  $j$ th indicator,  $W_j$  represents the weight of the  $j$ th indicator.

###### 4.1.3 Generation of evaluation indicators

$$\begin{cases} U_1 = \sum_{z=1}^n S_z R_z \\ U_2 = \sum_{y=1}^m S_y R_y \end{cases} \quad (6)$$

(6) where  $U_1$  and  $U_2$  are DEL and RRL comprehensive evaluation indexes, respectively,  $S_k$  is the weight of digital economy index  $k$ , and  $R_k$  is the standardized value,  $R_l$  is the weight value of rural revitalization index  $l$ ,  $R_l$  is the standardized value of rural revitalization indexes, and  $n$  and  $m$  are the number of DEL and RRL indexes, respectively.

###### 4.1.4 CCD model

Coupling was first applied to physics and later widely used in the social sciences. It represents the degree to which two or more systems interact. It was later developed into the "CCD model" to assess the evolution of CCD between systems. It was proposed by Li et al (2018), and the model is used to evaluate the CCD between DEL and RRL. the specific formula is as follows.

$$C = \frac{U_1 \cdot U_2}{\sqrt{\left(\frac{U_1 + U_2}{2}\right)^2}} = \frac{2\sqrt{U_1 \cdot U_2}}{U_1 + U_2} \tag{7}$$

$$D = \sqrt{C * T} = \sqrt{C * (\epsilon U_1 + \epsilon U_2)} \tag{8}$$

In Eqs. (7) and (8), C is the coupling degree of DEL and RRL,  $U_1$  denotes DEL,  $U_2$  denotes RRL, and  $C \in [0,1]$  denotes the strength of the interaction between the two, T is the composite coordination index of DEL and RRL reflecting the overall synergistic effect. l and m denote the weights of DEL and RRL, respectively, with  $\lambda + \mu = 1$ , and D is CCD,  $d \in [0,1]$ .

Note: In the traditional CCD model, l and m are generally determined by subjective factors and are set to l: m = 1:1, indicating that both systems are equally important.

**4.1.5 Handicap model**

Analyzing the factors that hinder the development of CCD can provide some suggestions for formulating and adjusting related development policies. Therefore, this paper introduces the obstacle degree model to determine the main obstacles to CCD between the plains and the plains in Xinjiang. The calculation of barrier degree involves three indicators: factor contribution, indicator deviation and barrier [40]. The factor contribution level indicates the contribution value of a factor to the total, which is expressed by the weight of a single factor  $w_j$ , the indicator deviation degree refers to the difference between the actual value and the optimal value of each indicator, which is usually expressed as  $I_{ij} = 1 - x_{ij}$ , and the obstacle degree,  $Z_{ij}$  indicates the degree of influence of each indicator or factor at the criterion level on CCD. The formula is:

$$Z_{ij} = \frac{I_{ij} w_j}{\sum_{j=1}^n I_{ij} w_j} \tag{9}$$

**4.2 Indicator Construction**

Since DEL and RRL are affected by a variety of factors, we have established their indicator systems separately. Combined with the definition of digital economy, it can be found that the indicator system includes not only infrastructures such as computer networks and information and communication equipment, but also service scenarios such as telecommunication business and digital finance. In this paper, we draw on the indicator selection method of Ye and Liu and take 14 Xinjiang cities as the research object [7]. Five secondary indicators are constructed under the three primary indicators of digital infrastructure, digital investment and digital integration development based on data availability and content similarity (Table 1). As far as the indicators of rural revitalization are concerned, rural revitalization is a long-term historical issue, and its development is a continuous dynamic process that should involve all aspects of social and economic life. Therefore, we integrated the research of Fang and Mao et al. and constructed a rural revitalization indicator system. The indicator system takes into account the unique development characteristics of Xinjiang and balances data availability and representativeness. In the end, we identified eight specific indicators to measure rural revitalization in Xinjiang (Table 1).

**Table 1** Digital economy and rural revitalization evaluation index system

Key indicators	Tier 1 indicators	Tier 2 indicators	Weight
Digital Economy Development Index	digital infrastructure	Internet penetration rate (set)	0.290
		Telephone Information Services per Capita	0.299
	Digital Convergence	Digital Inclusive Finance Index (%)	0.100
	Development	Per capita education expenditure (CNY)	0.201
		Percentage of Information Talent Practitioners (%)	0.110
Rural Revitalization Index	Digital betting	Per capita afforestation area (ha/million people)	0.052
	environment	Number of hospital beds per 10,000 population (beds)	0.032
		Harmless garbage disposal rate (%)	0.050
	commercialization	Domestic Tourism Income (million yuan)	0.239
	civilization	Investment in Fixed Assets for Education (million yuan)	0.157

prosperity	Disposable Income of Rural Residents (RMB)	0.124
social governance	General Public Budget Expenditure (million yuan)	0.058

### 4.3 Empirical Analysis

#### 4.3.1 DEL (Digital Economy Level) measurement

Analysis of DEL and RRL To examine the development of DEL and RRL in Xinjiang, it is first necessary to measure their comprehensive evaluation indicators. On the basis of the existing index research system, the entropy weight method is used to calculate the weight of each index, Eqs. (1)-(6). As shown in Table 1, digital infrastructure accounts for 58.9% of the total weight, digital investment accounts for 31.1%, and digital integration development accounts for 10%. Digital infrastructure occupies an important position in the digital economic system, which confirms that the modern information network is an important carrier of the digital economy, and the effective use of ICT is the driving force to improve the level of development of the digital economy. In Table 1, the indicator weights of the five factors of enterprise prosperity, comfortable living environment, civilized social etiquette, effective governance and prosperity are 25.9%, 8.9%, 27.7%, 22.1% and 15.4% respectively. The three domains of business prosperity, civilized social etiquette, and effective governance have a greater impact on RRL.

Based on the weights of the indicators, equation (6) was utilized to calculate the DEL of Xinjiang for 2016 - 2019 (Table 2). Considering the geographic location and economic development level of the 14 prefectures (cities), we divided the 14 prefectures (cities) into North, South and East Xinjiang for analysis.

**Table 2** Xinjiang DEL (Digital Economy Level) measurement

Distribution	County or City	2016	2017	2018	2019
Northern Xinjiang	Urumqi	0.497	0.576	0.634	0.612
	Karamay	0.480	0.592	0.596	0.489
	Changji Hui Autonomous Region	0.297	0.389	0.356	0.336
	Yili	0.191	0.280	0.272	0.358
	Tacheng	0.184	0.384	0.270	0.325
	Altay	0.427	0.379	0.382	0.401
	Baltimore Mongol Autonomous Prefecture	0.240	0.424	0.421	0.405
Eastern Xinjiang	Turpan	0.237	0.291	0.264	0.342
	Hami	0.282	0.296	0.375	0.446
	Bazhou	0.405	0.622	0.593	0.421
	Asu	0.244	0.304	0.248	0.312
Southern Xinjiang	Kashgar	0.188	0.258	0.258	0.248
	Kashgar	0.141	0.241	0.227	0.264
	Khotan	0.144	0.165	0.192	0.234
Xinjiang average		0.282643	0.3715	0.363429	0.370929

As shown in Table 2, the DEL in Xinjiang shows a slow increasing trend from 2016 - 2019. The overall DEL in Xinjiang increased from 0.2826 to 0.370929. this reflects the great importance Xinjiang attaches to the digital economy. In recent years, China and Xinjiang province have formulated many DEL upgrading implementation programs, such as expanding and upgrading information consumption, developing the industrial Internet, and implementing a three-year action plan to encourage Xinjiang enterprises to use cloud technology. These have contributed to the booming development of the digital economy in Xinjiang. However, due to Xinjiang's vast geographic area and high degree of urban dispersion, there is a "digital divide".

#### 4.3.2 Measurement of RRL

According to the index system constructed in Table 1, equation (6) is used to calculate the rural revitalization index of Xinjiang from 2016 - 2019. The RRL of Xinjiang is shown in Table 3.

**Table 3** Xinjiang RRL (Rural Revitalization Level) Indicator

Distribution	County or City	2016	2017	2018	2019
Northern Xinjiang	Urumqi	0.281	0.288	0.364	0.475
	Karamay	0.176	0.178	0.306	0.289
	Changji Hui Autonomous Region	0.408	0.416	0.326	0.424
	Yili	0.226	0.234	0.266	0.359
	Tacheng	0.257	0.254	0.258	0.266
	Altay	0.182	0.178	0.217	0.241
	Baltimore Mongol Autonomous Prefecture	0.081	0.186	0.201	0.205
Eastern Xinjiang	Turpan	0.167	0.173	0.169	0.178
	Hami	0.122	0.142	0.144	0.138
	Bazhou	0.264	0.261	0.249	0.282
Southern Xinjiang	Asu	0.287	0.284	0.273	0.315
	Kashgar	0.105	0.102	0.15	0.121
	Kashgar	0.225	0.384	0.401	0.412
	Khotan	0.119	0.229	0.332	0.245
Xinjiang average		0.20714	0.236357	0.258643	0.282143

As shown in Table 3, from 2016 to 2019, the RRL of Xinjiang has continued to increase, from 0.207 to 0.282. From 2017 to 2019, the development of RRL in Xinjiang has grown significantly. This is because, during this period, China has continuously implemented a series of measures to revitalize the countryside, laying a solid foundation for the construction of a beautiful and livable modern countryside, and at the same time providing a historic opportunity for the development of the rural economy. In line with the development strategy, specific projects have been carried out in this regard and have been effective in rural construction.

Regionally, Xinjiang's RRL is relatively unbalanced, showing a pattern of decline in the north, east and south. In order to more intuitively reflect its spatial distribution differences. The development level of rural revitalization in Northern Xinjiang, led by Karamay and Changji, is higher than that in Southern Xinjiang. In 2016, rural revitalization efforts were increased across the region, and the development of rural areas in Northern Xinjiang was relatively balanced, there were obvious regional differences in Southern Xinjiang. Bazhou and Kashgar had higher levels, while Hotan and Kezhou had lower levels. The rural revitalization index of Turpan and Hami in the eastern region of Xinjiang is lower than 0.13, lagging behind other regions. In 2019, thanks to the great development of the southern border, Xinjiang's rural revitalization has been effective. The overall level of the northern border has been improving, showing a fan effect centered on Urumqi, the southern border region of Kashgar has successfully crossed into the first echelon of rural revitalization, with a development index of more than 0.35, and the development of rural revitalization in Hami and Kexu has been relatively slow and needs to be improved.

Rural revitalization is a multi-factor and multi-dimensional dynamic development process. According to the weights of the indicators in equation (6), the scores of the five dimensions of the rural revitalization system are calculated to reflect the changes that have occurred in the countryside at different levels, as shown in Figure 3. In terms of time, the levels of the five level 1 indices are all on an upward trend, with similar trends of change. Among them, Industrial Prosperity and Effective Governance show the largest increase, while Comfortable Living Environment and Prosperity show relatively small increases.

RRL showed a good growth trend, rising from 0.132 to 0.270. Since the Central Document No. 1 of 2014, which proposed deepening rural reforms and promoting agricultural modernization, the Xinjiang government has invested a large amount of financial, human, and material resources in support of rural development, which has greatly improved the level of rural governance. In 2018, the country introduced the Rural Revitalization Strategy as a package of policies to formulate the Rural Revitalization roadmap, and rural development entered a new stage. Long-term poverty, inconvenient transportation and weak industrial development in some areas of Xinjiang have constrained rural development. To achieve rural revitalization, poverty must first be eliminated. As of 2018, Xinjiang has implemented precise poverty alleviation policies, lifting 537,000 poor people out of poverty, improving the problem of lagging rural development, and effectively upgrading the level of local governance. In recent years, the country has paid more attention to the construction of ecological civilization, which has promoted the construction of blue sky and green water ecology in Xinjiang.

#### 4.3.3 Analysis of CCD between DEL and RRL

As shown in Table 4, the development of CCD in Xinjiang is broadly divided into two phases: the first phase is from

2016 to 2017, focusing on the improvement of RRL, the second phase is from 2018 to 2019, focusing on the development of rural revitalization.

**Table 4** Table showing the extent of change in DEL and RRL

Year	2016	2017	2018	2019	Mean
Digital Economy Development Index	0.271	0.310	0.351	0.369	0.32525
Growth $\Delta U_1$		0.041	0.018	0.028	0.0029
Rural Revitalization Development Index	0.192	0.235	0.274	0.287	0.301
Growth $\Delta U_2$		0.043	0.039	0.013	0.031

#### 4.3.4 Diagnostic Analysis of Disorder Factors

Improving Xinjiang's regional development plan and regional development planning to achieve high-quality coordination requires both taking the national strategic plan as a top-level design and recognizing the obstacles in the development process. Through the obstacle degree model, we calculated the obstacle degrees of digital infrastructure (V1), digital investment (V2), digital integration and development (V3), business prosperity (V4), pleasant living environment (V5), social etiquette and civilization (V6), effective governance (V7), and prosperity (V8) in different years by using formula. The specific results are shown in Table 5.

**Table 5** Factors that hinder the extent of coupled and harmonized development (%)

Year	V1	V2	V3	V4	V5	V6	V7	V8
2016	34.7	20.65	2.18	8.8	4.6	10.39	13.28	5.4
2017	21.8	8.52	3.52	16.2	3.75	15.22	16.89	14.2
2018	18.84	10.42	3.59	16.49	4.8	20.01	16.02	11.53
2019	22.5	8.88	6.84	14.93	5.92	18.29	16.22	12.34

Considering the obstacles posed by the factors, digital infrastructure, rural civilization, digital investment and effective governance have a more significant impact on CCD between DEL and RRL. In the first stage of CCD development (2016-2017), the top three factors in the degree of hindrance are digital infrastructure, digital investment and effective governance, with an average annual degree of hindrance of 34.72%, 20.65% and 16.98%, respectively. The digital infrastructure and digital investment subsystems are expanding and their impact on CCD development has increased. The subsystems of pleasant human environment, business prosperity, and prosperity fluctuate less and have a relatively stable impact on CCD development. The Digital Convergence Development subsystem declines significantly, and its impact on CCD development gradually diminishes. In the second stage (2017 - 2019), digital infrastructure, business prosperity and social etiquette and civilization are the main factors, with annual average obstacles of 22.5%, 18.29% and 1.17%, respectively. The rural revitalization strategy has intensified the barriers of the rural revitalization subsystems and deepened the impact on CCD development.

It was found that the digital infrastructure subsystem had the highest degree of hindrance and the digital integrated development and pleasant living environment subsystems had the weakest degree of hindrance. This indirectly proves that digital infrastructure, which is the cornerstone of the digital economy and covers the three areas of Internet, communication and transportation, has a greater impact on DEL. In addition, in the process of rural development, digital infrastructure construction can utilize ICT to integrate traditional industries, drive the flow of technology, materials, capital and talents throughout rural areas, break the barriers of the urban-rural dichotomy, and improve the rural economy. Local finance has promoted the development of rural network infrastructure, improved the digital management mechanism of rural roads, and made up for the lack of rural digital infrastructure. However, local finance has not invested enough in digital inclusive finance and ecologically sustainable social construction, making its development process relatively slow and its impact on CCD weakened.

In the second stage (2018 - 2019), the average barrier degree of business prosperity and social etiquette and civilization increases significantly. This indicates that the impact of business prosperity, social etiquette and civilization on coupled coordinated development is strengthened in this phase. Prosperous business includes three aspects: agricultural production, mechanization level and tourism. For a long time, rural areas have been dominated by agricultural production. Insufficient rural labor force, low level of agricultural mechanization, and relatively irrational structure of agricultural industry have led to lagging development of secondary and tertiary industries, affecting the process of rural development. Tourism is a strategic pillar industry in Xinjiang. The integration and development momentum brought by "Tourism Plus" has promoted the integration and development of tourism and agriculture, animal husbandry, forestry, ecology and health in Xinjiang, which is conducive to the structural adjustment of Xinjiang's economy, promotes the employment of local residents, and gradually improves the quality of life of residents. The construction of rural

civilization is an important part of the rural revitalization strategy, and is also a practice of the "Nourishing Xinjiang with Culture" project. On the one hand, it can cultivate good rural customs, family and folk customs, stimulate rural cultural creativity, and lay the foundation for creating unique rural tourism. On the other hand, through the investment in culture and education, it can improve the cultural quality of farmers, strengthen the popularization of rural information and communication technology, alleviate the situation of lagging development of rural information and communication technology, and promote the establishment of rural data resource system. In the process of exploring the coupled coordination obstacle factors, it is found that the obstacle factors have gradually shifted from the early digitalization problems to the rural problems, which also confirms that the level of the digital economy in Xinjiang is increasing. However, the rural revitalization strategy was proposed late, and the rural development in some areas is still relatively backward, which affects the development process of DEL and RRL CCD in Xinjiang.

## 5 CONCLUSIONS AND POLICY RECOMMENDATIONS

### 5.1 Conclusions

With the continuous development and wide application of digital technology, the digital economy has gradually spread to rural areas, promoting the integration of modern and traditional industries, improving rural infrastructure, and having a significant impact on rural development. At present, few scholars in academia have studied the relationship between digital economy and rural revitalization from the perspective of quantitative analysis. Therefore, this paper aims to conduct an empirical study on the development of rural revitalization in Xinjiang driven by digital economy. And the improved CCD model was used to evaluate the CCD of 14 counties. In addition, the barrier value of first-level indicators to CCD was calculated using the barrier degree model, and the impact of each indicator at different stages of coupled coordination was discussed.

The conclusions drawn in this paper are as follows: From the combined scores of the two systems, we find that Xinjiang's digital economy and Xinjiang's rural revitalization have made some progress over the years, and the overall level is on an upward trend. Among them, the northern border has the best development, followed by the eastern border, and the southern border is relatively backward. Overall, the DEL in Xinjiang is better than the RRL, and there is a lot of room for the development of the RRL in Xinjiang's districts. In the second stage (2017 - 2019), RRL develops faster than DEL. analyzing from the perspective of economic benefits, the rural revitalization strategy initiated by the state in this period has positively affected the development of Xinjiang's countryside and brought good social benefits, and the level of Xinjiang's rural revitalization has increased dramatically. the results of the CCD model show that the development of CCD between DEL and RRL can be divided into two stages . In the first stage (2016 - 2017), the development of DEL is superior to rural revitalization in Xinjiang, with a weight ratio of 0.6:0.4. In the second stage (2018 - 2019), the development of rural revitalization is superior to the development of DEL, with a weight ratio of 0.38 to 0.62. The interaction between DEL and RRL is gradually enhanced. The CCD of 14 prefectures and cities has improved, but there is still significant regional heterogeneity, manifested as high in northern Xinjiang and low in southern Xinjiang.

In summary, this paper has conducted a basic research on digital economy development and rural revitalization in Xinjiang, which enriches the research content in the field of digital economy. At the same time, taking Xinjiang as the research object, it fills the current research gap on the development of digital economy and rural revitalization in remote areas. In addition, studying the spatial and temporal differences and bottlenecks in the development of digital economy and rural revitalization can provide reference for academics to explore the high-quality development of the two, enrich the current theoretical research, and provide feasible suggestions for promoting regional development.

### 5.2 Policy Recommendations

After analysis, we found that the development of CCD of DEL and RRL in Xinjiang has increased year by year, but there is still a long way to go from the perspective of high-quality coordination. How to use the power of the digital economy to promote the comprehensive development of rural areas, improve the level of rural development and achieve balanced rural development? On this basis, this paper puts forward suggestions to promote the coordinated development of the two.

(1) Effectively promote industrial prosperity and improve the level of digital technology application in rural industry. Strengthen the construction of rural digital industry, build the whole industry chain, and strengthen the integration and application of blockchain, Internet of Things, big data, artificial intelligence and other modern technologies in the five major aspects of rural revitalization. For example, digital technology should be fully utilized in the circulation of agricultural products to ensure the quality and safety of agricultural products, increase farmers' income, and create a high-level, high-quality rural e-commerce industry. It is necessary to seize the location advantage of the Silk Road Economic Belt, promote digital trade exchanges and cooperation between countries and regions, and utilize the power of digital development to push more Xinjiang specialty products into the international market.

(2) Promote coordinated and integrated regional development according to local conditions. From a regional perspective, the northern border has the strongest coupling and coordination capacity, followed by the eastern and southern borders. Therefore, in order to realize the comprehensive and coordinated development of Xinjiang, we will continue to improve the development plan for the northern border region and take the lead in sharing experiences and good practices with the eastern and southern border regions. At the same time, the East and South Xinjiang regions will also rely on rural resources, give full play to the unique advantages of local scenery, local culture, and specialty agriculture, and actively cultivate industries such as tourist agriculture and farming experience, so as to build a new rural digital economy based on tourism.

## COMPETING INTERESTS

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

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# RESEARCH ON THE SUPPLY CHAIN MANAGEMENT STRATEGY OF AGRICULTURE PRODUCTS IN HENAN PROVINCE DURING THE “INTERNET+” ERA

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**Abstract:** In the context of the "Internet +" era, the development of agricultural product supply chain in Henan Province faces both novel opportunities and significant challenges. This paper takes Henan Province as the research entry point, reviews the development status and problems of agricultural products in Henan Province. Subsequently, it delves into the pros and cons of the agricultural product supply chain development in Henan Province, providing a comprehensive analysis. And finally puts forward that under the background of "Internet +" era, The future development strategy of agricultural product supply chain in Henan Province also provides certain reference significance for China's agricultural product supply chain.

**Keywords:** Internet +; Agricultural supply chain; Management strategy

## 1 CONNOTATIONS OF AGRICULTURAL SUPPLY CHAINS

### 1.1 The substantive Content of Agricultural Supply Chains

The essence of supply chain is the vertical integration of enterprises, and the National Standard of the People's Republic of China - Logistics Terminology defines supply chain as the network chain structure formed by providing products or services to end-users in the production and distribution chain. Agricultural supply chain is a kind of functional network chain structure with specific scope of agricultural products. It includes suppliers of products (including suppliers of production materials such as seeds and agricultural tools), producers (producers of agricultural products), processors of agricultural products, distributors (wholesalers and retailers), and consumers of agricultural products.

### 1.2 Characterization of Agricultural Supply Chains

#### 1.2.1 Difficulty in establishing synergistic mechanisms in the agricultural supply chain

There is a complex and lengthy waiting process from production to consumption of agricultural products. The contradiction between the low market share of core enterprises in the supply chain and the need for a high degree of coordination among the various links in the supply chain has led to an increase in the cost of cooperation.

#### 1.2.2 Fragmentation of nodes in the agricultural supply chain

Owing to the natural attributes of agricultural products and objective reasons, different varieties of agricultural products require different production environments, resulting in the dispersal of agricultural production areas and the relatively limited scale of production. In addition, the lack of professional training and guidance for practitioners has led to a low level of standardized and specialized agricultural production.

#### 1.2.3 Difficulties in realizing information sharing at all stages of the agricultural supply chain

The supply chain of agricultural products covers a number of links, of which farmers are the main nodes, and at present there is a general problem of relatively poor information networks and communication facilities. The need for immediacy of information in agricultural products transactions is high, which leads to difficulties in the transmission of

information. Consumers of agricultural products, due to the special influence of their regions and ethnic customs, have great differences and diversities in consumer preferences, and there are still difficulties in integrating this key information to the producers of agricultural products in a timely manner.

## **2 DEVELOPMENT STATUS AND PROBLEMS OF AGRICULTURAL SUPPLY CHAIN IN HENAN PROVINCE**

### **2.1 Overall Production of Agricultural Products in Henan Province**

Located in the hinterland of the Central Plains, Henan Province is blessed with a unique geographic location and excellent conditions for the development of agriculture. At the same time, the output of grain, cotton, edible oil and other major agricultural products in Henan Province is among the highest in the country, and it is one of the important production bases of high-quality agricultural products in China. In recent years, the comprehensive agricultural production capacity of Henan Province has been steadily improved, the industrialization of agriculture has been rapidly developing, and the infrastructure has been continuously improved. The overall agricultural resources in Henan Province are relatively rich, but the relative resources per capita are insufficient.

### **2.2 The Current Status of Agricultural Supply Chain Development in Henan Province**

#### ***2.2.1 The logistics infrastructure for agricultural products is constantly being improved***

The market structure of agricultural products in Henan Province is diversified. From the perspective of specialization, the markets for agricultural products are divided into two kinds, one is comprehensive and the other is specialized, one is a large market with a turnover of more than one hundred million yuan, and the other is a small and medium-sized trading market. The number of comprehensive wholesale markets for agricultural and sideline products in Henan Province and the number of wholesale markets with a sales volume of more than one hundred million yuan have increased significantly.

#### ***2.2.2 The gradual improvement of various transportation routes***

At present, the logistics transportation of agricultural products in Henan Province mainly passes through railroads, highways and inland waterways, and the rapid development of highways and high-speed railways in Henan Province has continuously improved the transportation capacity. Based on the strategic geographic location of Henan Province, the mileage of railroad has been growing steadily, and the operation capacity has been strengthened significantly.

#### ***2.2.3 The coverage of rural information networks is constantly improving***

With the development of network technology and the popularization of 5G technology, the development of communication industry in Henan Province has also been greatly developed. From the perspective of the continuous expansion of communication network scale and the rapid improvement of technical level and service level, these factors have laid a solid foundation for the development of rural informatization.

### **2.3 Problems in the Development of Agricultural Supply Chain in Henan Province**

#### ***2.3.1 Decentralization of the various actors involved in agricultural logistics***

The first stop in the agricultural supply chain is for farmers to move the harvested agricultural products from the field to their homes by means of transportation, and then to realize the process of sorting, packaging, conveying and marketing. At present, after receiving the agricultural products, farmers have two main ways to sell them, one is to carry out some simple processing through their own means of transportation and transport them to the place of sale, or package them for sale in the wholesalers' place. Selling. The second is through intermediary traffickers, neither of which is organized in any way; they simply rely on the product itself, and the dispersed transport makes the intermediate stages more expensive. This means that, while reducing their own incomes, they also cause the market price of the produce to rise, thus significantly reducing their incomes.

#### ***2.3.2 Agricultural logistics technology lags behind***

Agricultural products delivery technology is backward, farmers send the harvested agricultural products to their homes, or the traditional mode of transportation, the application of modern transportation technology is rare, which also leads to high logistics costs of agricultural products, especially fruits and vegetables and other agricultural products that are not easy to preserve. Agricultural products circulation and processing technology is backward, and there are fewer deep-processing enterprises in Henan Province that comprehensively utilize agricultural products, and if there are any, they mostly process agricultural products at the primary level, and the value chain of agricultural products has not been fully explored.

### **3 SWOT ANALYSIS OF AGRICULTURAL PRODUCTS SUPPLY CHAIN DEVELOPMENT IN HENAN PROVINCE**

#### **3.1 Analysis of the Advantages of Efficient Development of Agricultural Supply Chain in Henan Province**

##### ***3.1.1 Rich in agricultural resources***

Henan Province, with its vast area and rich material resources, is the main producer of agricultural products such as wheat, corn, oilseeds and cotton, and ranks first in the country in terms of livestock products such as meat, eggs and milk. Grain production in Henan Province in 2023 is expected to reach 132.5 billion kilograms. Henan is the second largest province in the country in terms of area under cultivation and production of grain, second only to Heilongjiang Province, and is truly the "Grain Silo of China".

##### ***3.1.2 Strategically located***

Henan Province is located in the Central Plains, which is the middle zone for the transfer of industries from the east to the central and western parts of China, and is also the necessary route for the circulation of resources from the west to the economically developed areas on the eastern coast; Henan Province has a diverse terrain, and the geographic boundary between the north and the south of China passes through the territory of Henan Province, and its climate is characterized by the distinct seasons of spring, summer, fall and winter, and the same period of rainfall and heat, which is suitable for the growth of many kinds of agricultural crops; at the same time, the Huaihe River and the Yellow River pass through the territory of Henan Province, which guarantees the water supply for irrigation of agricultural production. Meanwhile, the Huaihe River and the Yellow River pass through Henan, guaranteeing the irrigation water for agricultural production. These favorable natural conditions provide a strong guarantee for the planting and cultivation of agricultural products in Henan.

##### ***3.1.3 Market and cost advantages***

Henan Province is a "large population province" with strong radiation-driven capability. Henan's large population can provide sufficient labor for agricultural production and cheap labor for the logistics industry, which is also a labor-intensive industry. As a result, the prices of exported agricultural products will fall and become more competitive in the international market.

##### ***3.1.4 Transportation and logistics advantages***

Henan Province has obvious transportation advantages, the Beijing-Guangzhou Railway, Beijing-Kowloon Railway, Longhai Railway and other 9 major railroad lines in China pass through Henan Province, forming a crisscross railroad network. The pace of high-speed railway construction in Henan Province is accelerating, and the highway network in Henan Province is well-connected, forming a radioactive highway network; the civil aviation industry in Henan Province is developing rapidly, with 31 cargo airlines operating at Zhengzhou Airport and 48 cargo routes in operation. Henan's modern comprehensive transportation system and the increasingly perfect modern comprehensive transportation system, for Henan Province, rapid cargo collection and distribution and reduce logistics costs provide great advantages; Henan Province has tens of millions of labor resources, most of the colleges and universities for the logistics industry to train professional and technical personnel. More and more logistics enterprises are growing rapidly, and the core competitiveness of logistics enterprises in Henan Province is increasing.

#### **3.2 Analysis of the Disadvantages of Agricultural Supply Chain Development in Henan Province**

### ***3.2.1 Poor information systems for agricultural products and weak outward economic development***

As a traditional agricultural province, Henan Province has a rich variety of agricultural products, which provides sufficient supply for the export of agricultural products. However, due to the fact that Henan Province is located inland, not along the border, not along the coast, and far away from the sea ports, its degree of economic openness is relatively low, which leads to the weak development of outward-oriented economy in Henan Province. At the same time, due to the status of Henan Province as a major agricultural province, with a vast rural areas, rural areas, closed information, a single source of information, agricultural information network is backward, so that the majority of rural areas are difficult to receive information on foreign agricultural products, resulting in the sale of agricultural products of the international awareness of the low, can not keep abreast of the international demand for agricultural products, resulting in cross-border sales of agricultural products of the incentive is not high.

### ***3.2.2 High logistics costs, slow speed, imperfect logistics system***

The rapid development of supply chain management of agricultural products in Henan Province has high requirements for logistics, due to the specificity of agricultural products, the timeliness of its logistics and distribution requirements are even stronger, the development of the logistics industry in Henan Province can be found in the current situation of the infrastructure construction of the starting point is low, the scale is small, synergistic operation ability is weak and other related shortcomings, resulting in the current logistics system is relatively inefficient, and also indirectly caused by logistics The cost of logistics is rising. Although Henan Province has a superior location and convenient transportation advantages, but compared with other logistics e-commerce, economically developed regions, logistics development time is relatively short, the foundation is still relatively weak, infrastructure is not perfect, logistics information technology is not high, logistics system construction is unreasonable, resulting in the current logistics system in Henan Province fails to meet the needs of high-speed transportation of agricultural products in Henan Province.

### ***3.2.3 Low level of logistics technology***

In agricultural storage, storage facilities are backward, many kinds of agricultural products need a certain degree of fresh storage, so that the storage and preservation of agricultural products have certain requirements. From the current situation, the storage capacity of agricultural products in Henan, there is a certain gap, and there are many general-purpose strong special warehouses, such as cold storage, low-temperature warehouse, three-dimensional warehouse, such as the number of specialized warehouses is seriously inadequate.

In the transportation of agricultural products, for food transportation, is still mainly packaged transportation, which will cause a lot of waste, did not use the optimization of logistics management to prevent, resulting in all kinds of unreasonable transportation phenomenon in the transportation of agricultural products. This also can not be effective protection of agricultural products, in the process of transportation loss is very large, can not be effective food preservation and preservation, to extend the shelf life of food.

At present, China's agricultural products logistics informationization construction is still in the stage of development and improvement. There is a lack of professionals, such as cyberspace construction, the opening of a unified market, the Internet of Things, wireless radio and other high-tech applications have not yet been popularized.

### ***3.2.4 The irrational structure of the agricultural market system***

There are many types and numbers of markets in Henan Province. However, the current agricultural market in Henan Province is still dominated by the traditional farmers' market, other types of large-scale integrated wholesale markets are fewer in number, uneven distribution, there are imperfect infrastructure, complete protection system is not sound and other related issues. At present, most of the agricultural markets have simple business premises and backward facilities, which cannot provide consumers with efficient processing, preservation and storage services.

## **3.3 Analysis of Opportunities for the Development of Agricultural Supply Chains in Henan Province**

### ***3.3.1 Wide market space***

As we all know, Henan Province is a large population and agricultural province with abundant labor resources, but in

the past, many laborers preferred to work in the coastal cities in the south, but now more and more laborers are choosing to work at their doorsteps due to the rapid development of the local area or the impact of the new crown epidemic. In addition, a large number of excellent enterprises will move their factories to Henan, which will greatly increase the demand for agricultural products in Henan, thus accelerating the development of the agricultural supply chain in Henan. With the steady improvement of the quantity and quality of agricultural products in Henan Province, the rise of a large number of local brands of agricultural products in Henan Province, more and more enterprises outside the province on the demand for agricultural products in Henan Province is growing, in the international market, international trade demand for agricultural products has also been soaring, which also puts forward higher requirements for the management of the supply chain of agricultural products in Henan Province.

### **3.3.2 Strong government support for the logistics industry**

The main feature of the logistics industry is that it employs a large number of people, involves a wide range of fields, absorbs a large number of employment, and plays a great role in promoting production and stimulating consumption, which fully explains the role of the logistics industry in promoting the national economy as a whole. In recent years, the government of Henan Province has attached great importance to the logistics industry and strongly supported the development of the logistics industry. At present, Henan has built up a central logistics hub in Zhengzhou as the focus, Luoyang, Shangqiu, Anyang, Nanyang, Xinyang five regional logistics hubs as the support, mutual coordination, reasonable layout of the network logistics system. At the same time in order to better utilize the advantages of Henan Province in natural resources, industrial products, Henan Province has identified eight categories of food, cotton, food and other industrial logistics development priorities.

## **3.4 Threats Encountered During the Development of Agricultural Supply Chains in Henan Province**

### **3.4.1 Higher requirements related to logistics in the agricultural supply chain**

Because of the unique characteristics of agricultural products, such as perishable, seasonal, not good preservation, etc., in addition, different agricultural products harvesting time is not the same, so the time of transportation logistics and preservation of freshness conditions put forward higher requirements, and finally, agricultural products from planting to harvesting takes a certain amount of time, but people's demand for agricultural products has always existed, and so the supply and demand information is sometimes there is an asymmetry, and all of this has put forward higher requirements for the supply chain of agricultural products. All these have put forward higher requirements for the supply chain of agricultural products.

### **3.4.2 High hidden costs in the agricultural supply chain**

In recent years, despite the emergence of a number of leading enterprises related to agricultural products in Henan, such as Mudyuan, White Elephant, Shuanghui and Sanquan, which have done a good job in the processing of agricultural products, the supply chain cost of agricultural products is still on the high side. In addition, agricultural products are an indispensable part of people's life, its consumer group is relatively small, and it can be found that the demand of individual consumers for agricultural products is not very large. This leads to high costs in agricultural trade and is not conducive to the formation of a stable supply chain.

## **4 STRATEGIES FOR DEVELOPING THE SUPPLY CHAIN OF AGRICULTURAL PRODUCTS IN HENAN PROVINCE IN THE ERA OF "INTERNET PLUS"**

In order to develop the supply chain of agricultural products in Henan Province better and better, it needs the cooperation of the government, enterprises and farmers. According to the current situation of agricultural supply chain management in Henan Province, the following strategies are organized.

### **4.1 Integration of Resources and Strengthening of Joint Efforts and Cooperation among Agricultural Logistics Enterprises**

The government should call for the integration of existing agricultural logistics enterprises, the establishment of third-party logistics enterprises, so that agricultural production, processing, storage, transportation, sales and other different logistics activities of the operator and the logistics business in many areas to concentrate together, to give play to the effect of scale, the establishment of large logistics services group. Actively cultivate agricultural intermediary service institutions, for farmers need food planting, food collection and other professional agricultural knowledge for guidance, so that farmers' production is not blind, targeted, but also able to organize the effective supply of agricultural materials in a timely manner, agricultural intermediary service organizations can connect farmers and the market, pay attention to market dynamics in a timely manner, timely feedback to the farmers, and the farmers to communicate fully, so that farmers less detour and promote the good development of agricultural products logistics. Good development of agricultural logistics.

#### **4.2 Promoting Standardized Production of Agricultural Products and Raising the Level of Technology**

At present, the various links in the supply chain of agricultural products in Henan Province have not been standardized management, which is an urgent problem. The root cause is that the production and processing of agricultural products have not formed a unified standard. Therefore, promoting the standardization of agricultural products production link will lay a solid foundation for the benign development of agricultural products supply chain management in Henan Province. With the improvement of people's economy and living standard, people have put forward better requirements on the quality, specification and packaging of agricultural products, therefore, farmers should strictly follow the green product standard and organic agricultural product standard in the production and operation process, and categorize the harvested agricultural products and classify them according to the difference in quality, specification and quality of packaging.

#### **4.3 Cultivate Logistics Talents and Form a Modern Logistics Team for Agricultural Products**

Today's society, people have a higher demand for logistics technology, whether it is to enhance the level of equipment, or software system upgrades, we need more high-tech personnel. At present, the demand for logistics personnel in Henan Province has a large gap. In addition, logistics companies are also emerging, with the demand for talent is also increasing. However, at present, many logistics companies are still made up of individual small companies, their capital is very limited, and their staff culture and professional and technical level is limited. Therefore, it is necessary for the government and enterprises to take the lead to increase the introduction of relevant talents, only in this way can the advanced modern logistics management ideas into reality, thus greatly reducing the unnecessary costs of logistics companies, in order to better enhance the efficiency of the logistics company, enhance the competitiveness of the company. At the same time, the institutions of higher learning in Henan Province should vigorously develop the logistics-related disciplines and strengthen the training of students' practical skills in order to meet the needs of enterprises for talents.

#### **4.4 Strengthening the Legal System and Standardizing the Tax System**

Government departments should accelerate the improvement of the regulatory environment of the agricultural supply chain, and at the same time actively promote the legislative process of the relevant laws, and further amend the deficiencies and loopholes in the existing laws. In addition, the government departments also need to further improve the logistics market access legislation, more efficient management of agricultural logistics market enterprises, and will be included in a perfect agricultural tax system, so that the rights of farmers and consumers to get effective protection, and then protect the interests of all parties, and for the country to open up a new way of tax revenue, so that the enterprise and the entire logistics chain of each link can be benefited from. The benefits will be realized by the enterprises and all the links in the whole logistics chain.

## **5 CONCLUSION**

At present, there are still many problems in the supply chain management of agricultural products in Henan Province. Under this circumstance, it is very necessary to put forward supply chain management strategy for agricultural products. On the premise of giving full play to the main advantage of "The Belt and Road Initiative", Henan Province should at the same time give full play to its own advantages of airports, seize the opportunities, effectively avoid the risks, and utilize the Internet technology to promote the realization of new growth of agricultural products in Henan Province.

## **COMPETING INTERESTS**

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# A LITERATURE REVIEW ON THE INTEGRATION OF CULTURE AND TOURISM ALONG THE TANG POETRY ROAD IN EASTERN ZHEJIANG

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**Abstract:** This paper reviews the current state and development of research on cultural tourism integration under the background of the Eastern Zhejiang Tang Poetry Road. As one of the birthplaces of ancient Chinese civilization, Shaoxing boasts a long history and rich cultural heritage. In recent years, with in-depth studies in folklore, history, and archaeology, understanding of the ancient city of Shaoxing has gradually deepened. Scholars have conducted research from various perspectives, including history, material culture, and spiritual culture, resulting in numerous monographs and papers. This paper focuses on reviewing these research achievements, covering Shaoxing's historical evolution, culinary culture, local customs, ancient bridges, scenic spots, and notable figures and operas. In terms of cultural tourism integration, Shaoxing, based on its abundant cultural resources, is gradually exploring the deep integration of culture and tourism. Despite the progress made, current research still has systemic inadequacies and lacks theoretical depth, indicating the need for further enhancement.

**Keywords:** Tang Poetry Road in Eastern Zhejiang; Shaoxing; Culture-tourism integration; Literature review

## 1 INTRODUCTION

Eastern Zhejiang is a region known for its picturesque landscapes and rich cultural heritage, admired by scholars and poets throughout history. "Eastern Zhejiang has always been known as the land of poetry, its essence especially concentrated in ancient Wozhou. The harmonious rhythm of the mountains and rivers along the way is more splendid than silk." This is how the renowned Sinologist Qigong praised it[1]. To explore the essence of Eastern Zhejiang's culture, one must delve into the culture of Yuezhou. To study Yuezhou's culture, it is essential to mention the "Tang Poetry Road." "Eastern Zhejiang", as the name implies, refers to the eastern part of Zhejiang Province, which includes present-day Shaoxing, Ningbo, and Taizhou regions. Historically, it was a term used for the area under the jurisdiction of the Zhejiang Eastern Inspectorate during the Tang Dynasty, roughly demarcated by the Xin'an River, Fuchun River, and Qiantang River to the east and south. This included the prefectures of Yue, Wu, Ming, Tai, Wen, Chu, and Qu[2]. Since the inspectorate was stationed in Yuezhou, the term sometimes also referred to this broader region, encompassing a wider definition of Eastern Zhejiang. The academic field of Tang poetry considers the "Tang Poetry Road" in Eastern Zhejiang to be synonymous with "Yuezhou," which includes parts of Yuezhou, Mingzhou, and Taizhou, corresponding to today's Shaoxing, Ningbo, Zhoushan, and up to Taizhou in Zhejiang Province[3]. This is a more specific delineation of Eastern Zhejiang.

Due to varying definitions of the Eastern Zhejiang region, there are currently two main routes of the "Tang Poetry Road": one route goes upstream along the Qiantang River, passing through Mu, Wu, and Qu prefectures, and finally heading south to Wenzhou; this route is also called the "Qiantang River Tang Poetry Road." The other route involves crossing the Qiantang River from Yuputan in Xiaoshan and Xiling into the Eastern Zhejiang Canal, traveling along the canal to Yuezhou, then taking the waterway to Haoba and entering Cao'e River, through Shanxi to Tiantai Mountain, and from there to Mingzhou or south to Wenzhou.

## 2 GENERAL INTRODUCTION TO THE TANG POETRY ROAD IN EASTERN ZHEJIANG

Here are many interpretations of the Tang Poetry Road both nationally and within Zhejiang. Nationally, there are the "Two Capitals Tang Poetry Road," "Guanlong Tang Poetry Road," and "Western Shu Tang Poetry Road." Within Zhejiang, there are the "Tang Poetry Road in Eastern Zhejiang," "Western Zhejiang Tang Poetry Road," "Two Zhejiang Tang Poetry Road," "Zhejiang Tang Poetry Road," and "Qiantang River Tang Poetry Road," among which the concept of the "Tang Poetry Road in Eastern Zhejiang" was proposed the earliest and has the most significant impact. It has become a specialized term in Chinese literary history, with important historical and cultural research value. Scholars have repeatedly studied the "Tang Poetry Road in Eastern Zhejiang," generally agreeing that "the Tang Poetry Road in Eastern Zhejiang can be compared to the Hexi Silk Road, both being regions of significant cultural and historical importance during the Tang Dynasty"[4].

Research on the Tang Poetry Road in Eastern Zhejiang not only reflects a comprehensive understanding of Tang poets' works and lifestyles, enriching the field of Tang Dynasty literary studies and enhancing research outcomes related to the Tang Poetry Road in Eastern Zhejiang but also serves as an important focus for studying Chinese traditional culture. Moreover, it is key to overcoming the current challenges in tourism development. It has, to some extent, pioneered a



advancing the revitalization, materialization, and sublimation of traditional culture. This represents a Zhejiang solution new field of cultural tourism research, promoting the tourism industry's return to its essential attributes. This allows excellent traditional culture to be revived in modern times through more concrete and direct forms via scenic carriers, and a Chinese solution for the inheritance and innovation of traditional culture, aiding in the creation of cultural and civilized highlands in Zhejiang and setting an example of cultural-tourism integration, providing new insights and methods for future tourism research.

Shaoxing, as the core area and initiator of the Tang Poetry Road in Eastern Zhejiang, leads in both the construction and research of the poetry road cultural belt, making it a typical and representative case. Through exploring effective paths for the cultural-tourism integration of the Tang Poetry Road in Eastern Zhejiang in Shaoxing, it is possible to better understand and promote the development and construction of the entire poetry road cultural belt. To further demonstrate the feasibility and necessity of the cultural-tourism integration of the Tang Poetry Road in Eastern Zhejiang, existing literature has been reviewed, and the current state of related research is as follows.

### 3 THE SPECIALIZED RESEARCH ON THE TANG POETRY ROAD IN EASTERN ZHEJIANG

The concept of the "Tang Poetry Road in Eastern Zhejiang" originated in the field of Tang Dynasty literature research. In May 1991, at the First International Academic Symposium on Tang and Song Poetry held in Xinchang, Shaoxing, Zhejiang, scholar Zhu Yuebing first proposed the concept of the Tang Poetry Road in the Eastern Zhejiang region.[5] In August 1993, the Chinese Society of Tang Dynasty Literature officially recognized the "Tang Poetry Road in Eastern Zhejiang." [6] This specialized research on the Tang Poetry Road in Eastern Zhejiang has received enthusiastic attention and positive responses from Tang poetry researchers at home and abroad. At the Seventh Annual Conference of the Chinese Society of Tang Dynasty Literature held in Xinchang, Zhejiang, in 1994, a dedicated session on the relationship between Zhejiang's landscapes and literature was organized, providing a meaningful exploration of the topic. [7] Subsequently, as the cultural extension of the poetry road progressed, there was a call within academia for comprehensive and systematic works to delineate and reproduce the creative aspects and basic outlines of the Tang Poetry Road in Eastern Zhejiang. Consequently, numerous related works, academic papers, and conference papers have emerged.

In terms of academic monographs, several scholars, including Zou Zhifang, Zhu Yuebing, and Lu Shengjiang, have made outstanding contributions. Based on original materials provided by *The Complete Collection of Tang Poetry* and *The Supplement to the Complete Collection of Tang Poetry*, they have compiled collections of poetry reflecting the local customs and landscapes of Eastern Zhejiang, publishing a series of *Tang Poetry Road in Eastern Zhejiang* poetry collections. The book *Tang Poetry Road in Eastern Zhejiang*, compiled by Zou Zhifang and published by Zhejiang Ancient Books Publishing House in 1995, was the first to be published, containing about 500 poems, rich in empirical materials. It adopts a linear structural approach, with the Eastern Zhejiang Canal and Shanxi River as the main axis, threading 41 renowned scenic spots along this ancient tourist route with 207 representative works. The book meticulously elaborates on the historical origins, cultural backgrounds, and local customs of each scenic spot, as well as scrutinizes the activities of Tang Dynasty poets in Eastern Zhejiang. According to their research, there were over 60 local Tang Dynasty poets along this route, with at least 400 poets wandering along the Tang Poetry Road in Eastern Zhejiang. Mr. Zhu Yuebing, as the initiator of the *Tang Poetry Road*, has published the *Tang Poetry Road Series*, including *General Discussion on the Tang Poetry Road* (China Literature and History Press, 2003), *Comprehensive Collection of Tang Poetry on the Tang Poetry Road* (China Literature and History Press, 2003), and *Biographies of Tang Dynasty Poets on the Tang Poetry Road* (China Literature and History Press, 2004). These three books, all based on the Eastern Zhejiang region, extensively investigate and study the Tang Dynasty poets who visited the area and their works. Among them, the *Comprehensive Collection of Tang Poetry* categorically records a series of 1505 poems by Tang Dynasty poets praising the landscapes of Eastern Zhejiang. [8] *General Discussion* records the natural scenery and cultural landscapes of the Shanxi area in Zhejiang, while *Biographies of Tang Dynasty Poets* systematically introduces the life stories and activities of Tang poets in Eastern Zhejiang. According to statistics, there were a total of 451 Tang Dynasty poets who visited the Tang Poetry Road in Eastern Zhejiang, including well-known poets such as Li Bai, Du Fu, Wang Wei, Meng Haoran, Wang Changling, Cen Shen, Bai Juyi, Yuan Zhen, Li He, Jia Dao, Du Mu, and Li Shangyin. [9] Later, Lu Shengjiang's *Complete Compilation of Tang Poetry on the Tang Poetry Road in Eastern Zhejiang* (Zhonghua Book Company, 2022) supplemented the relevant Tang poems of Eastern Zhejiang, arranged them according to the authors' birth years, and briefly introduced the authors' life spans, birthplaces or hometowns, whether they had visited Eastern Zhejiang, and when they visited.

In terms of monographs, besides comprehensively and systematically organizing Tang poems related to the Zhejiang Eastern Poetry Road, some scholars have focused on specific important nodes of the poetry road or selected only certain poems as their research focus, compiling relevant poetry collections. Representative examples of the former include *Selected Tang Poems of the Qiantang River Tang Poetry Road* by Jiang Jianyong, Yan Yan, and Lei Shuilian (China Water Conservancy and Hydropower Press, 2019), *Selected Inscriptions of Tian Tai Mountain Poetry on the Tang Poetry Road in Eastern Zhejiang* by Sun Xinlong (Xi Ling Yin She Press, 2021), and *Talking about Zhuji on the Tang Poetry Road - Three Hundred Tang Poems of Zhuji* by Chen Kanzhang and Yu Wenjun (Zhejiang University Press, 2021). The latter includes *Selected Poems of the Tang Poetry Road in Eastern Zhejiang* published by the Zhejiang Provincial Academy of Literature and History (Hangzhou Publishing House Co., Ltd., 2021). Additionally, there are related works that focus on the cultural reflections of Tang poetry in Eastern Zhejiang. Representative works in this

regard include Li Zhaohong's *Chronological History of Academic Culture of the Tang Poetry Road in Eastern Zhejiang* (China Book Company Limited, 2022) and Hu Zhengwu's *Eastern Zhejiang Tang Poetry Road and Recluse Culture* (China Social Sciences Press, 2006). The former, in the form of a chronological history, comprehensively and systematically records the entire process of the academic and cultural development of the Tang Poetry Road in Eastern Zhejiang from 1967 to 2020, demonstrating the organic integration of academic research and cultural construction under the overarching theme of the Tang Poetry Road in Eastern Zhejiang. This is not only a comprehensive summary of the current research achievements of the Tang Poetry Road in Eastern Zhejiang, but also promotes and looks forward to the research on Tang Poetry Roads nationwide. It has not only promoted people's understanding of the cultural significance of the Tang Poetry Road in Eastern Zhejiang but also laid the foundation for the cultural brand of the Tang Poetry Road in Eastern Zhejiang.

In terms of master's and doctoral theses, there are not many specialized studies on the Tang Poetry Road in Eastern Zhejiang. Doctoral dissertations have not been seen yet, and only four master's theses were found through search, most of which are combined with cultural tourism or heritage conservation. Among them, representative ones include Liu Chang's master's thesis *Research on the Distribution Characteristics and Spatial Planning of the Tang Poetry Road in Eastern Zhejiang from the Perspective of Heritage Corridor* (Zhejiang University, 2021) and Bao Yuye's master's thesis *Study on the "Eastern Zhejiang Tang Poetry Road" based on Linear Cultural Heritage* (Zhejiang University, 2021). These theses mainly discuss the resource value of the Eastern Zhejiang poetry road from the perspective of heritage conservation, identify the heritage of the "Eastern Zhejiang Tang Poetry Road," and analyze the geographical location and distribution characteristics of various heritage sites, providing some reference for the protection and utilization of the Eastern Zhejiang Tang Poetry Road in practice. In addition, Mei Siyu's master's thesis *Research on the Production of Documentary Films in Zhejiang Poetry Road Cultural Belt* and Zhan Piaopiao's master's thesis *Research on the Life and Poetry of Tang Dynasty Poet Shi Jianwu* (Ningbo University, 2012) take a different approach. The former relies on theories such as cultural geography, narrative theory, and tacit knowledge to focus on the creation form of documentary films on intangible cultural heritage themes, literati themes, and red themes in the Zhejiang poetry road cultural belt, providing a cultural review and artistic reflection on the creation of documentary films on the Zhejiang poetry road cultural belt. The latter studies the life and poetry of the poet Shi Jianwu, exploring the relationship between his poetry and the Tang Poetry Road in Eastern Zhejiang, showcasing the scenery and charm along the Eastern Zhejiang Poetry Road.

The academic research on the Tang Poetry Road began in the 1990s. Many single papers have been produced, mainly focusing on the analysis and discussion of the historical origins of the Tang Poetry Road in the field of Tang Dynasty literature research. For example, in his article *On the Historical Origins of the 'Tang Poetry Road'* (Tang Dynasty Literature Research, 1994), Qian Maozhu analyzed the regional cultural advantages and objective conditions of Eastern Zhejiang, pointing out that the emergence of the Eastern Zhejiang Tang Poetry Road was not accidental, but had profound social and historical reasons. Hu Kexian, in *Xiling Fishery: The Starting Point of the Eastern Zhejiang Tang Poetry Road* (Zhejiang Social Sciences, 2022), provided multidimensional arguments to demonstrate that Xiling and Fishery are the starting points of the Tang Poetry Road in Eastern Zhejiang. Lin Jiali and Wang Yanqing proposed in *Mount Kuaiji Landscape Poetry and the Tang Poetry Road in Eastern Zhejiang* (Journal of Zhejiang Shuren University, Issue 6, 2019) that the Southern Dynasties landscape poetry represented by Xie Lingyun played a key role in guiding the later writing of landscape poetry on the Tang Poetry Road in Eastern Zhejiang, paving the way for the maturity of Tang landscape poetry. In addition, many papers have discussed the Tang Poetry Road from spatial and geographical perspectives, such as Zhu Yuebing's *Yanxi: The Tang Poetry Road* (Tang Dynasty Literature Research, 1996) and Xu Zhilin and Yu Ting's *Cultural Coordinates and Inheritance Value of the Eastern Zhejiang Tang Poetry Road* (Journal of Zhejiang Water Conservancy and Hydropower College, Issue 4, 2019). In 2017, Wang Zhaopeng led the creation of the *Tang and Song Literature Chronological Map* in collaboration with Sou-yun Poetry, which presents the life trajectories of poets from the Tang (618-907 AD) and Song (960-1279 AD) dynasties categorized by poets and introduces the poetry works created by poets at different locations, providing more visual evidence for future research on the Eastern Zhejiang Tang Poetry Road. With the rise of cultural tourism, people have realized the potential value of the Tang Poetry Road in tourism development and begun to study the Tang Poetry Road from the perspective of tourism. For example, Xiao Weige's *Exploration of the Integrated Development of Cultural Tourism along the Eastern Zhejiang Tang Poetry Road* (Journal of Shaoxing University of Arts and Sciences, Issue 1, 2020), Yu Chunxiu's *Cultural Protection Strategies for Geographical Names under the Background of Tourism Development of the Eastern Zhejiang Tang Poetry Road* (Contemporary Tourism, 2021), and Zhai Wenqian and Li Lingjie's *Construction and Dissemination of the Cultural Image of the Eastern Zhejiang Tang Poetry Road* (Modern Media, 2020), among others.

#### 4 THE SPECIALIZED RESEARCH ON SHAOXING CULTURE

Shaoxing is one of the birthplaces of ancient Chinese civilization. With a history of nearly 2500 years since its establishment in the Spring and Autumn period, Shaoxing has maintained its city site unchanged over the millennia. [10] Its profound historical and cultural heritage, both material and spiritual, has played a significant role in the evolution of Chinese civilization over the past five thousand years. In recent years, with in-depth exploration in fields such as folklore, history, and archaeology, people's understanding of the ancient city of Shaoxing has gradually deepened, revealing its true face.

Scholars have written monographs and papers on various aspects of Shaoxing's general history, material culture, and spiritual culture. Monographs often provide an overview of Shaoxing's overall historical development and humanistic characteristics. For instance, Xiao Ying's *Shaoxing* (Tourism Education Press, 2001) introduces the city's urban overview, historical evolution, important events, famous landmarks, local characteristics, and prominent figures, emphasizing that Shaoxing is not only an ancient city but also a vibrant modern metropolis. Other monographs focus on specific aspects, such as Chen Qiao Yi's *Shaoxing Historical Stories* (Shanghai People's Publishing House, 1982), which uses historical records to discuss ancient situations in the Shaoxing area.

Regarding Shaoxing's cultural dissertations and journal articles, they often focus on a particular material resource or cultural type of Shaoxing as the starting point for exposition. They are integrated with teaching, tourism, or literary creation. Master's theses mainly dominate this area, with few doctoral dissertations. For example, Chen Yuehua's master's thesis *Exploring Lu Xun's Works Teaching Based on Shaoxing Cultural Background* (Zhejiang Normal University, 2007) analyzes the characteristics of Shaoxing culture in Lu Xun's works from the perspective of Shaoxing's regional background. Gold Lijiao's master's thesis *Research on the Core Competitiveness of Shaoxing Cultural Tourism* (East China Normal University, 2006) identifies Shaoxing's cultural tourism core competitiveness by analyzing the current development of Shaoxing cultural tourism and applying relevant management theories.

Individual papers often delve into various aspects of Shaoxing culture, such as place names, liquor, Yu the Great, and Shun, offering comprehensive analyses. Hou Youlan's research focuses on Shaoxing's place names, revealing the cultural connotations within them. Liang Yong discusses the regional culture of Yue and suggests establishing a research system named "Shaoxing Studies." Zhu Ying emphasizes the importance of inheriting and protecting the Shaoxing dialect as a carrier of Shaoxing culture. Additionally, many individual papers explore Shaoxing's cultural tourism, aiming to promote its tourism development and product transformation through its rich cultural resources.

Such papers include *From Tourist City to Urban Tourism: Reflections on the Development of Shaoxing Cultural Tourism* (Journal of Shaoxing University, 2005, Issue 5) and Shi Zhengdong's *Shaoxing Cultural Industry Development and Government Positioning* (Journal of Shaoxing University, 2012, Issue 1).

Overall, the study of Shaoxing's culture is extensive and diverse, ranging from general histories to specific aspects like cuisine, customs, and dialects. These studies not only contribute to a deeper understanding of Shaoxing's rich cultural heritage but also offer insights into its potential for tourism development and cultural preservation.

## 5 THE SPECIALIZED RESEARCH ON CULTURAL AND TOURISM INTEGRATION

The discussion of the relationship between culture and tourism has always been a core topic in the development of Chinese tourism and a hot research area in academia. Regarding monographs, there is Pan Lili's *Exploration of the Theory of Cultural and Tourism Integration and the Practice of Industrial Development in Zhejiang* (Zhejiang Gongshang University Press, 2021), which explores cultural and tourism integration theoretically and analyzes the process of cultural and tourism integration development in Zhejiang practically, providing a reference model for the development of cultural tourism in Zhejiang Province. Additionally, there is *Case Studies on International Cultural and Tourism Integration Demonstration* edited by Pang Xuequan (Sichuan People's Publishing House, 2020), which discusses the main aspects and elements involved in cultural and tourism integration, highlighting the many interrelations between them as the intrinsic conditions and foundations for achieving cultural and tourism integration. The book explores six possible paths for cultural and tourism integration and selects 30 successful cases of cultural and tourism integration that are well-known both domestically and internationally. By deeply analyzing the planning ideas and implementation paths of these successful cases, it provides reference materials for the further development of cultural and tourism integration.

Furthermore, there is Bian Xianhong's *Research on the Interactive Development Path of Cultural and Tourism Integration in the New Era: Taking Several Cases of Cultural and Tourism Integration Development as Examples* (China Tourism Publishing House, 2020), which explores new paths for cultural and tourism integration development in the new era using examples from various cities in Zhejiang, Anhui, and Qinghai provinces. In addition to monographs, there have been many achievements in single-paper articles. In 2020, the *Guizhou Ethnic Studies* published a special research article on *Cultural and Tourism Integration Development*, which attracted attention from various sectors of society including academia, government, and the business community. In 2022, the journal published three special articles: Zhang Jijiao and Shao Weihang's *Modern Transformation of Urban Old Streets' Market Culture Heritage from the Perspective of Neo-classical "Structure-Function Theory"—Taking the Old Streets in Beijing as an Example*, Wang Zhuo's *Craftsman Effect: Three Types of Main Function Construction of Old Brand Cultural Memory*, and Fang Jingwen's *Practice of Ethnic Cultural and Tourism Integration in Baoting: Taking Binglanggu and Yanoda as Examples*. These articles mainly focus on the application research of the "structure-function theory" of cultural and tourism integration development and the special discussion of cultural construction and the revitalization of cultural heritage tourism.

Of course, some scholars have focused on a particular city as an important research scope to explore the feasibility and necessity of cultural and tourism integration in that city. As a historical and cultural city and the essence of the Tang Poetry Road in East Zhejiang, research on the integration of culture and tourism in Shaoxing has become increasingly mature. Relevant articles have been published in journals, research reports, and news reports, but specialized works specifically addressing the cultural tourism of Shaoxing have not been seen yet. There are relatively few theses, with examples such as Tao Songlan's *Research on Marketing Strategy of Shaoxing Ancient City Tourism Brand* (Lanzhou

University of Technology, 2016) and Ding Yun's *Research on the Development of Shaoxing Cultural and Leisure Tourism* (Zhejiang Normal University, 2013). Journal articles mostly concentrate on Shaoxing research from the perspective of cultural and tourism integration, such as Chang Ying's *Research on the Protection and Utilization of Shaoxing Ancient City from the Perspective of Cultural and Tourism Integration* (China Business Review, 2019), Yuan Jianwei and Ye Wenjing's *Research on Innovative Development of Shaoxing Tourism Industry from the Perspective of Cultural and Tourism Integration* (Journal of Shaoxing University, 2022), and Xiang Diyan's *Research on the Development Strategy of Shaoxing Cultural Celebrity Culture IP from the Perspective of Cultural and Tourism Integration* (Tourism and Photography, 2022). In addition, scholars have proposed constructive opinions on the development path and strategy of Shaoxing cultural tourism, such as Du Fuli's *Analysis of the Development Path of Shaoxing Section of the Tang Poetry Road in East Zhejiang* (Cultural Tourism, 2020), Zheng Lixia's *Research on Shaoxing Cultural Tourism Integration Development Strategy* (Tourism Economy, 2022), and He Junjie's *Shaoxing Research Travel: Decoding the Model Strength of Urban Cultural Tourism Integration* (Chinese Cultural Newspaper, 2021), among others.

In recent years, to promote the further development of tourism in Shaoxing, emphasis has been placed on deeply excavating the cultural connotation of Shaoxing, using culture to deepen the meaning of tourism. Various academic conferences and research reports on Shaoxing cultural tourism have been released successively. In 2021, the Shaoxing Cultural Tourism Research Report 2019-2020 was compiled, including general reports and special reports. The *Annual Report on the Development of Cultural and Tourism Industries in Shaoxing City 2019-2020* (Report of the Shaoxing Municipal Bureau of Culture, Radio, Television, and Tourism, 2021) by Li Xiangyin and Yu Ting summarizes the main achievements and development opportunities of Shaoxing cultural tourism, pointing out the current trend of cultural tourism industry development and summarizing the current situation of Shaoxing cultural tourism and proposing solutions. Special reports cover topics such as comprehensive tourism development and consumption, rural homestays, "culture + tourism" demonstration bases, study tours, and cultural tourism IP attractions, with representative scholars including Zhu Wenbin, Xu Zheyu, Shang Yunfeng, Xie Bingqin, Liu Zhaoming, Chen Hengjin, Cao Jing, and Yang Xiaoping. Additionally, there are many documents specifically discussing the development of the Tang Poetry Road in East Zhejiang and cultural and tourism integration, planning and promoting the development of cultural tourism and the poetry route in Shaoxing from the perspective of policies and regulations. These documents can generally be divided into three parts: provincial-level policy planning, municipal-level policy planning, and news reports. Provincial-level documents include the *Zhejiang Province Action Plan for Inheriting and Developing Excellent Traditional Culture of Zhejiang Province* (Report of the Zhejiang Provincial Government, 2018), the *Fourteenth Five-Year Plan for the Development of Tourism Industry in Zhejiang Province*, and the *Implementation Opinions of the People's Government of Zhejiang Province on Promoting the Deep Integration and High-Quality Development of Culture and Tourism Industries* (Document of the People's Government of Zhejiang Province, 2022). Municipal-level documents mainly include the *Fourteenth Five-Year Plan for Culture and Tourism in Shaoxing* (Document of the Shaoxing Municipal People's Government, 2021) and the *Action Plan to Accelerate the Urban Internationalization of Shaoxing 2020-2022* (Document of the Office of the Shaoxing Municipal People's Government, 2020).

## 6 CONCLUSION

In summary, it is evident that the Tang Poetry Road in Eastern Zhejiang holds a crucial and unique position in the construction of the Zhejiang Poetry Road cultural belt. However, current research on this topic has several shortcomings. Studies on the integration of cultural tourism under the background of the Tang Poetry Road in Eastern Zhejiang are relatively scattered and lack a systematic approach. Academic research perspectives are rather singular, and the depth of research is insufficient. Many works are popular readings rather than in-depth academic studies, indicating a need for further systematic deepening.

Research on the Eastern Zhejiang Poetry Road, based on its cultural and historical significance, provides crucial theoretical support for subsequent tourism development. However, transforming intangible cultural resources into tangible tourism products, thereby achieving a transition from a historical and literary path to a tourism and industrial path, requires an effective medium for implementation. Given the current state of preservation, research on the Eastern Zhejiang Poetry Road predominantly exists in written form, with few physical artifacts. These artifacts are widely scattered and not systematically organized. Existing studies largely focus on theoretical analysis without offering an effective tourism medium.

As a result, to date, no feasible physical tourism route for the Eastern Zhejiang Tang Poetry has been developed, and there is no distinctive Poetry Road brand. This situation has hindered the establishment of a unique Poetry Road Cultural Tourism brand.

## COMPETING INTERESTS

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

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# ORGANIZATIONAL CITIZENSHIP BEHAVIOR FOR PREPARING GEN-Z IN THE MODERN ERA: A COMPREHENSIVE REVIEW

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**Abstract:** This academic journal article offers a comprehensive review of Organizational Citizenship Behavior (OCB) and its critical role in preparing Generation Z (Gen-Z) employees for the modern workplace. With Gen-Z's increasing presence in the workforce, organizations encounter unique challenges in maximizing their potential and securing their engagement and commitment. Recognized for its positive impact on organizational effectiveness, OCB encompasses voluntary and discretionary behaviors that go beyond formal job descriptions. This paper delves into the theoretical foundations of OCB, explores its various dimensions, and examines its implications for Gen-Z employees in contemporary work environments. Furthermore, it provides evidence-based strategies and interventions that organizations can implement to cultivate OCB among Gen-Z employees, thereby enhancing their performance and job satisfaction. The study concludes with insights into the reliability and validity of these strategies and offers recommendations for future research and organizational practice.

**Keywords:** Organizational citizenship behavior; Gen-Z; Modern era; Workplace; Employee engagement; Organizational effectiveness

## 1 INTRODUCTION

The modern era workplace is undergoing profound transformations as it welcomes the entry of Generation Z (Gen-Z) employees. Born between the mid-1990s and early 2010s, Gen-Z individuals bring with them a distinctive set of characteristics, perspectives, and expectations that have the potential to reshape the organizational landscape. To effectively integrate and prepare Gen-Z employees for the demands of the modern workplace, organizations must gain a deep understanding of their motivations, behaviors, and patterns of engagement[1]. This article aims to explore the concept of Organizational Citizenship Behavior (OCB) and its relevance in fostering Gen-Z employees' preparedness, engagement, and commitment within this rapidly evolving context.

Gen-Z employees, shaped by their upbringing in a digital and interconnected world, possess unique attributes that distinguish them from previous generations. They are characterized as tech-savvy, entrepreneurial, diverse, and value-driven individuals who prioritize authenticity, social responsibility, work-life balance, and personal development[2]. As digital natives, they bring an inherent familiarity with technology and a keen ability to navigate the rapidly changing digital landscape. Organizations must recognize and appreciate these distinctive qualities to effectively harness the potential of Gen-Z employees and create a mutually beneficial work environment.

In order to maximize the contributions of Gen-Z employees, organizations must be proactive in understanding their motivations, behaviors, and expectations[3]. Traditional approaches to employee engagement and management may need to be reevaluated and adapted to meet the needs of this new generation. This is where the concept of Organizational Citizenship Behavior (OCB) comes into play. OCB refers to voluntary, discretionary behaviors exhibited by employees that go beyond their job descriptions and contribute to the overall effectiveness and functioning of the organization. These behaviors include helping colleagues, engaging in positive communication, demonstrating altruism, and displaying loyalty to the organization[4].

OCB has been recognized for its positive impact on organizational effectiveness, as it fosters cooperation, trust, and positive interpersonal relationships among employees[5]. It is particularly relevant in the context of Gen-Z employees, who seek meaningful work, opportunities for growth, and a supportive work environment. By understanding and promoting OCB among Gen-Z employees, organizations can enhance their preparedness, engagement, and commitment, leading to improved performance and satisfaction.

This article aims to provide a comprehensive review of OCB and its implications for preparing Gen-Z employees in the modern era workplace. It will delve into the theoretical foundations of OCB, examine its dimensions, and discuss its specific implications for Gen-Z employees. Furthermore, the article will present strategies and interventions that organizations can employ to foster OCB among Gen-Z employees, ultimately enhancing their performance and satisfaction in the dynamic and evolving modern workplace[6]. So, as the modern workplace continues to evolve with the influx of Gen-Z employees, organizations must adapt their approaches to effectively integrate and prepare this unique generation. Understanding the motivations, behaviors, and engagement patterns of Gen-Z employees is crucial for organizations to thrive in this new era. By exploring the concept of OCB and its relevance in fostering Gen-Z employees' preparedness, engagement, and commitment, this article aims to provide valuable insights and practical strategies for organizations to succeed in harnessing the potential of the Gen-Z workforce[7].

## 2 LITERATURE REVIEW

### 2.1 The Concept of Organizational Citizenship Behavior

Organizational Citizenship Behavior (OCB) refers to discretionary, voluntary, and extra-role behaviors exhibited by employees, which are not explicitly stated in their job descriptions but contribute to the overall effectiveness and functioning of the organization. OCB encompasses a range of behaviors, including helping colleagues, engaging in positive communication, demonstrating altruism, and showing loyalty to the organization[8]. The dimensions of OCB commonly identified in the literature include altruism, conscientiousness, sportsmanship, courtesy, and civic virtue.

### 2.2 Theoretical Foundations of OCB

Several theoretical perspectives have been proposed to explain the concept of OCB. Social exchange theory suggests that individuals engage in OCB as a form of reciprocity, expecting future benefits or rewards from others or the organization in return. The norm of reciprocity plays a crucial role in fostering OCB. Another theoretical framework is the social identity theory, which posits that individuals engage in OCB to enhance their social identity within the organization and gain a sense of belongingness and self-esteem[9]. Additionally, the theory of planned behavior emphasizes the role of individual attitudes, subjective norms, and perceived behavioral control in predicting OCB.

### 2.3 Relationship between OCB and Organizational Effectiveness

Extensive research has demonstrated a positive relationship between OCB and organizational effectiveness. OCB has been linked to various desirable outcomes, including improved team performance, higher levels of customer satisfaction, enhanced creativity and innovation, reduced turnover, and increased organizational commitment. OCB contributes to the development of a positive work environment and fosters cooperation, trust, and positive interpersonal relationships among employees.

### 2.4 Generation Z in the Modern Era

Generation Z, also known as the post-millennial or iGeneration, comprises individuals born between the mid-1990s and early 2010s. Gen-Z employees exhibit distinct characteristics shaped by their upbringing in a digital and interconnected world. They are tech-savvy, entrepreneurial, diverse, and value authenticity, social responsibility, work-life balance, and personal development. Gen-Z employees seek meaningful work, opportunities for growth, and a supportive work environment.

### 2.5 Expectations and Motivations of Gen-Z in the Workplace

Gen-Z employees have unique expectations and motivations in the workplace. They seek a flexible and inclusive work environment that embraces diversity and provides opportunities for continuous learning and skill development. Gen-Z employees value meaningful work that aligns with their personal values and allows them to make a positive impact on society[10]. They expect regular feedback, recognition, and opportunities for career advancement.

### 2.6 Challenges in Engaging Gen-Z Employees

Engaging Gen-Z employees presents specific challenges for organizations. Gen-Z employees are characterized by shorter attention spans and a preference for instant gratification, which can affect their commitment and loyalty. Organizations need to adapt their strategies to effectively engage Gen-Z employees, considering their digital fluency, desire for autonomy, and need for purposeful work experiences.

### 2.7 Organizational Citizenship Behavior (OCB) and the Research Gaps Identified

The existing body of research provides a solid foundation for understanding the concept of OCB and its significance for organizational effectiveness. Studies have consistently demonstrated the positive relationship between OCB and desirable outcomes, such as improved team performance, higher customer satisfaction, and increased organizational commitment[8]. The theoretical frameworks of social exchange theory, social identity theory, and the theory of planned behavior have offered valuable insights into the motivational mechanisms underlying OCB[9]. However, the reviewed literature has primarily focused on understanding OCB in the context of previous generations, without adequately addressing the unique challenges and opportunities presented by the influx of Generation Z (Gen-Z) employees in the modern workplace. This represents a significant gap in the current research, as Gen-Z employees exhibit distinct characteristics and expectations that may require organizations to reevaluate their traditional approaches to employee engagement and management. The literature highlights the distinctive traits of Gen-Z, such as their tech-savviness, entrepreneurial mindset, and strong emphasis on work-life balance and personal development[3,11]. These unique characteristics may shape the way Gen-Z employees perceive and engage in OCB, which could differ from the patterns observed in earlier generations.

One key research gap is the lack of empirical investigations into the specific role of OCB in engaging and motivating Gen-Z employees. It remains unclear whether the different dimensions of OCB, such as altruism, conscientiousness, and civic virtue, resonate with and influence the behaviors and attitudes of this generation in the same way as they have with previous generations[4]. Additionally, there is a need to explore the potential moderating or mediating factors that may shape the relationship between OCB and Gen-Z employee outcomes. Factors like organizational culture, leadership styles, and HR practices may play a crucial role in fostering OCB and effectively engaging this generation[10].

The development and evaluation of interventions or HR strategies specifically designed to promote OCB among Gen-Z employees also represent a promising area for future research. This could involve exploring innovative approaches to onboarding, training, and performance management that align with the unique needs and expectations of this generation. By addressing these research gaps, scholars can provide organizations with evidence-based insights and practical recommendations for cultivating OCB and effectively integrating Gen-Z employees into the modern workplace. This knowledge can help organizations harness the potential of this emerging generation and create a mutually beneficial work environment that enhances their performance, engagement, and long-term commitment.

## 2.8 Methodology

This comprehensive review employed a document analysis methodology, drawing upon both secondary and primary sources to gain a thorough understanding of Organizational Citizenship Behavior (OCB) and its implications for preparing Generation Z (Gen-Z) employees in the modern workplace. The study relied on a systematic examination of existing literature, including academic journal articles, research reports, and scholarly books, to establish a solid theoretical foundation and identify relevant strategies for fostering OCB among Gen-Z employees. In addition to the secondary sources, the review incorporated insights from primary sources, specifically observations conducted by the researcher. These observations were carried out in various organizational settings where Gen-Z employees were present, allowing the researcher to gather first-hand information about their behaviors, interactions, and responses to different organizational practices and interventions. The observer focused on capturing instances of OCB among Gen-Z employees, as well as their reactions to leadership styles, organizational culture, and technological initiatives aimed at promoting OCB.

## 3 STRATEGIES FOR FOSTERING OCB AMONG GEN-Z EMPLOYEES

### 3.1 Leadership and Supervisory Practices

#### 3.1.1 Transformational leadership and its influence on OCB

Transformational leadership practices, such as providing a clear vision, inspiring followers, and stimulating intellectual growth, can positively influence OCB among Gen-Z employees. By fostering a supportive and empowering work environment, transformational leaders can motivate Gen-Z employees to engage in discretionary behaviors that benefit the organization. These leaders can articulate a compelling vision for the future, aligning it with Gen-Z's values of social responsibility and meaningful work, thereby encouraging them to go above and beyond their formal duties.

However, the effectiveness of transformational leadership in promoting OCB among Gen-Z might be contingent on the specific leadership style employed. While Gen-Z values authenticity and transparency in leadership, an overly charismatic or authoritative approach might be met with skepticism. This generation, known for its independent thinking and desire for autonomy, may respond better to a collaborative and inclusive leadership style that encourages their active participation in decision-making processes.

Furthermore, transformational leaders can effectively model OCB behaviors, setting a positive example for Gen-Z employees to emulate. By demonstrating altruism, conscientiousness, sportsmanship, courtesy, and civic virtue, leaders can inspire Gen-Z to internalize these values and exhibit them in their own actions. This approach aligns with social learning theory, which suggests that individuals learn by observing and imitating the behaviors of role models. Finally, transformational leaders can leverage individual initiative and empower Gen-Z employees to take ownership of their work, creating opportunities for them to contribute to the organization in meaningful ways. This sense of ownership and empowerment can foster a sense of responsibility and commitment, leading to increased OCB.

#### 3.1.2 Coaching and feedback for OCB enhancement

Effective coaching and regular feedback can enhance OCB among Gen-Z employees. Providing constructive feedback, recognizing and rewarding OCB behaviors, and offering guidance and support can motivate Gen-Z employees to continue exhibiting OCB[13]. Coaching sessions can also focus on developing interpersonal skills and promoting a culture of collaboration and teamwork[13]. This generation, raised in a feedback-rich environment, thrives on regular affirmation and constructive criticism.

However, the delivery method and frequency of feedback should be tailored to Gen-Z's preferences. While they value frequent feedback, traditional performance reviews conducted annually might be perceived as outdated and ineffective. Instead, incorporating technology-mediated feedback channels, such as instant messaging platforms or online performance dashboards, can provide real-time feedback and facilitate ongoing dialogue between supervisors and Gen-Z employees. This approach aligns with their preference for instant communication and digital fluency.

Moreover, coaching and feedback sessions should focus on developing Gen-Z's understanding of the specific OCB dimensions valued within the organization. By explicitly outlining the behaviors associated with altruism,



conscientiousness, sportsmanship, courtesy, and civic virtue, organizations can provide a clear roadmap for Gen-Z employees to follow. This approach can help bridge the gap between Gen-Z's expectations and the organizational norms surrounding OCB. Finally, organizations should encourage peer-to-peer feedback and recognition, leveraging Gen-Z's affinity for social interaction and online platforms. Implementing peer recognition programs or utilizing social media channels to acknowledge OCB behaviors can create a positive feedback loop, motivating Gen-Z employees to continuously strive for excellence and contribute to a supportive work environment.

## **3.2 Organizational Culture and Climate**

### ***3.2.1 Creating an inclusive and supportive organizational culture***

Organizations can foster OCB among Gen-Z employees by cultivating an inclusive and supportive organizational culture. Encouraging diversity, promoting open communication, and valuing employee contributions create an environment where Gen-Z employees feel comfortable and motivated to engage in OCB[12]. Organizations can establish norms and practices that promote teamwork, knowledge sharing, and mutual support[12]. Gen-Z, being the most diverse generation yet, thrives in environments that value inclusivity and respect individual differences.

However, fostering such a culture in a multigenerational workplace presents unique challenges. Organizations need to bridge the gap between the values and expectations of Gen-Z and those of older generations. This might involve implementing flexible work arrangements, promoting reverse mentoring programs, and facilitating intergenerational dialogues to foster mutual understanding and respect.

Furthermore, organizations should actively solicit feedback from Gen-Z employees regarding their experiences and suggestions for improvement. This generation, known for its outspokenness and desire for change, can offer valuable insights into how the organizational culture can be made more inclusive and supportive. Creating dedicated channels for Gen-Z to voice their opinions and participate in decision-making processes can empower them to contribute to shaping the organizational culture. Finally, organizations should ensure that their values and mission resonate with Gen-Z's desire for social responsibility and meaningful work. By demonstrating a commitment to ethical practices, environmental sustainability, and social impact initiatives, organizations can attract and retain Gen-Z talent while simultaneously fostering a culture that encourages OCB.

### ***3.2.2 Recognition and rewards for OCB***

Recognizing and rewarding OCB behaviors is crucial for fostering OCB among Gen-Z employees. Organizations can implement formal and informal recognition programs that acknowledge and appreciate employees' discretionary efforts[14]. Rewards can include verbal praise, certificates, promotions, or financial incentives. Recognizing and rewarding OCB not only motivates Gen-Z employees but also reinforces the importance of such behaviors within the organization. Gen-Z, being digitally savvy and accustomed to instant gratification, might respond well to recognition delivered through online platforms or social media channels.

However, organizations should avoid a one-size-fits-all approach to rewards. Gen-Z values personalized experiences and opportunities for growth. Therefore, offering a diverse range of rewards, such as personalized learning opportunities, mentorship programs, or opportunities to contribute to social impact initiatives, might be more effective than traditional monetary rewards.

Moreover, organizations should ensure that recognition and rewards for OCB are timely and specific. Gen-Z, accustomed to instant feedback and recognition, might not respond well to delayed or generic forms of appreciation. Organizations should leverage technology to provide real-time recognition and personalized rewards, catering to Gen-Z's preference for instant gratification and digital fluency. Finally, organizations should consider incorporating peer-to-peer recognition programs, allowing Gen-Z employees to acknowledge and reward each other's OCB behaviors. This approach can foster a sense of community and encourage collaboration, further strengthening the organizational culture and promoting OCB.

## **3.3 Technological Interventions**

### ***3.3.1 Leveraging technology to foster OCB among Gen-Z***

Organizations can leverage technology to foster OCB among Gen-Z employees. Digital platforms, intranets, and collaboration tools can facilitate knowledge sharing, communication, and engagement. Organizations can establish online communities where Gen-Z employees can contribute their ideas, provide support, and engage in collaborative problem-solving[15]. Additionally, organizations can utilize social media and gamification techniques to encourage and recognize OCB behaviors. This generation, having grown up immersed in technology, naturally gravitates towards digital tools and platforms.

However, organizations should be mindful of the potential pitfalls of over-reliance on technology. While digital platforms can facilitate communication and collaboration, they can also lead to information overload and digital fatigue. Striking a balance between online and offline interactions is crucial to avoid alienating employees who prefer face-to-face communication or those who might feel overwhelmed by the constant influx of digital information.

Furthermore, organizations should ensure that the technology employed is user-friendly and accessible to all Gen-Z employees, regardless of their technical proficiency. Providing adequate training and support can ensure that technology serves as a facilitator of OCB rather than a barrier to participation. Finally, organizations should leverage technology to create personalized learning experiences and development opportunities for Gen-Z employees. By offering online

courses, virtual mentorship programs, or digital platforms for skill-sharing, organizations can cater to Gen-Z's desire for continuous learning and professional growth, ultimately promoting OCB by empowering them to contribute their skills and knowledge to the organization.

### 3.3.2 Gamification and digital platforms for OCB enhancement

Gamification techniques can be employed to promote OCB among Gen-Z employees. Organizations can design interactive and engaging digital platforms that encourage Gen-Z employees to participate in OCB-related activities, earn points, and unlock rewards. Gamification elements such as leaderboards, badges, and challenges can motivate Gen-Z employees to exhibit OCB and foster a culture of continuous improvement and engagement. This approach can tap into their competitive spirit and desire for recognition within their peer group.

However, the effectiveness of gamification hinges on the design and implementation of the digital platforms. Simply incorporating game mechanics without a clear connection to organizational goals or meaningful rewards can lead to superficial engagement and ultimately fail to promote genuine OCB. Organizations should ensure that gamified platforms align with organizational values, promote collaboration and knowledge sharing, and offer rewards that resonate with Gen-Z's aspirations for personal and professional growth.

Moreover, organizations should ensure that gamified platforms are inclusive and accessible to all Gen-Z employees, regardless of their gaming experience or technical proficiency. Providing clear instructions, tutorials, and ongoing support can ensure that all Gen-Z employees can participate and benefit from the gamified experience. Finally, organizations should regularly evaluate the effectiveness of gamified platforms, gathering feedback from Gen-Z employees and making adjustments as needed. This iterative approach can ensure that gamification remains a relevant and engaging tool for promoting OCB among Gen-Z employees.

**Table 1** Summarizing The Strategies For Fostering OCB Among Gen-Z Employees

Strategies for Fostering OCB among Gen-Z Employees	Description
Transformational Leadership	Transformational leaders provide vision, inspiration, and intellectual stimulation to create a supportive and empowering work environment that motivates Gen-Z employees to engage in discretionary behaviors voluntarily, fostering OCB.
Coaching and Feedback	Effective coaching and regular feedback help enhance OCB among Gen-Z employees. Constructive feedback, recognition of OCB behaviors, and guidance and support encourage Gen-Z employees to continue exhibiting OCB. Coaching sessions can focus on developing interpersonal skills and promoting a culture of collaboration and teamwork.
Inclusive and Supportive Organizational Culture	Cultivating an inclusive and supportive culture that values diversity, promotes open communication, and recognizes employee contributions creates an environment where Gen-Z employees feel comfortable and motivated to engage in OCB. Establishing norms and practices that encourage teamwork, knowledge sharing, and mutual support is essential.
Recognition and Rewards	Recognizing and rewarding OCB behaviors is crucial for fostering OCB among Gen-Z employees. Implementing formal and informal recognition programs that acknowledge and appreciate employees' discretionary efforts, such as verbal praise, certificates, promotions, or financial incentives, motivates Gen-Z employees and reinforces the importance of OCB within the organization.
Leveraging Technology	Organizations can leverage technology to foster OCB among Gen-Z employees. Digital platforms, intranets, and collaboration tools facilitate knowledge sharing, communication, and engagement. Creating online communities where Gen-Z employees can contribute ideas, provide support, and engage in collaborative problem-solving encourages OCB. Social media and gamification techniques can also be utilized to encourage and recognize OCB behaviors.
Gamification and Digital Platforms	Gamification can be an effective strategy for promoting organizational citizenship behavior (OCB) among Generation Z employees. To maximize its impact, organizations should design interactive and engaging digital platforms that align with their values, encourage participation in OCB-related activities, and offer rewards that resonate with Gen-Z's aspirations. The success of gamification hinges on its inclusivity, accessibility, and ongoing support for all Gen-Z employees. Regular evaluation and iteration based on employee feedback are crucial to ensuring that gamification remains a relevant and engaging tool for fostering OCB among this generation.

## 4 DISCUSSION

The findings of this comprehensive review highlight the critical role of Organizational Citizenship Behavior (OCB) in preparing Generation Z (Gen-Z) employees for the modern workplace. The study's results align with existing literature, which emphasizes the positive impact of OCB on organizational effectiveness, employee engagement, and job satisfaction[7,10]. However, this review extends the current understanding by focusing specifically on the unique characteristics and expectations of Gen-Z employees, an area that has been relatively underexplored in previous research.

The review underscores the importance of fostering a supportive and inclusive organizational culture to promote OCB among Gen-Z employees. This finding is consistent with previous studies that have highlighted the role of organizational culture in shaping employee behaviors and attitudes[12]. However, the present review provides new insights by emphasizing the specific cultural elements that resonate with Gen-Z, such as diversity, open communication, and recognition of employee contributions. These findings suggest that organizations may need to adapt their cultural practices to effectively engage and motivate this emerging generation. Furthermore, the review identifies transformational leadership and effective coaching and feedback as key strategies for enhancing OCB among Gen-Z employees. While previous research has established the positive influence of transformational leadership on employee outcomes[2], this study contributes to the literature by exploring how transformational leadership practices can be tailored to meet the unique needs and preferences of Gen-Z. The emphasis on collaborative and inclusive leadership styles, as well as the importance of modeling OCB behaviors, provides practical insights for organizations seeking to develop effective leadership strategies for this generation.

The review also sheds light on the potential of technological interventions, such as gamification and digital platforms, in promoting OCB among Gen-Z employees. This finding is particularly relevant in the context of the modern workplace, where technology plays an increasingly central role in shaping employee experiences and interactions. While previous studies have explored the use of gamification in various organizational contexts[16], this review contributes to the literature by examining its specific application in fostering OCB among Gen-Z employees. The emphasis on designing inclusive, accessible, and meaningful gamified experiences provides valuable guidance for organizations looking to leverage technology to engage and motivate this digitally savvy generation. However, the review also acknowledges the potential challenges and limitations associated with these strategies. For instance, the effectiveness of transformational leadership in promoting OCB among Gen-Z may be contingent on the specific leadership style employed, and an overly authoritative approach may be met with skepticism. Similarly, while technology can facilitate communication and collaboration, organizations must be mindful of the potential pitfalls of over-reliance on digital platforms, such as information overload and digital fatigue. These findings highlight the need for organizations to carefully consider the nuances and complexities involved in implementing these strategies and to adopt a tailored approach that takes into account the unique characteristics and preferences of Gen-Z employees.

This comprehensive review contributes to the existing body of knowledge by providing a focused examination of OCB in the context of Gen-Z employees. The findings offer valuable insights and practical recommendations for organizations seeking to cultivate OCB and effectively integrate this emerging generation into the modern workplace. However, the review also identifies several areas for future research, such as empirical investigations into the specific dimensions of OCB that resonate with Gen-Z and the development and evaluation of targeted interventions to promote OCB among this generation. As organizations continue to navigate the challenges and opportunities presented by the influx of Gen-Z employees, further research in this area will be crucial to inform evidence-based practices and support the success of both individuals and organizations in the modern era. The findings of this comprehensive review provide valuable insights into the role of Organizational Citizenship Behavior (OCB) in preparing Generation Z (Gen-Z) employees for the modern workplace. The study's results corroborate existing literature, which emphasizes the positive impact of OCB on various organizational outcomes, such as employee performance, job satisfaction, and organizational commitment[8,17]. However, this review extends the current understanding by focusing specifically on the unique characteristics, expectations, and preferences of Gen-Z employees, an area that has received limited attention in previous research.

One of the key findings of this review is the importance of creating an inclusive and supportive organizational culture to foster OCB among Gen-Z employees. This finding aligns with previous studies that have highlighted the significant influence of organizational culture on employee attitudes and behaviors[18,19]. However, the present review provides new insights by identifying specific cultural elements that are particularly relevant to Gen-Z, such as diversity, open communication, and recognition of employee contributions. These findings suggest that organizations may need to reassess and adapt their cultural practices to effectively engage and motivate this emerging generation. For instance, organizations may need to prioritize diversity and inclusion initiatives, establish transparent communication channels, and implement recognition programs that align with Gen-Z's values and preferences. Furthermore, the review underscores the critical role of leadership in promoting OCB among Gen-Z employees. The findings highlight the effectiveness of transformational leadership practices, such as providing a clear vision, inspiring followers, and stimulating intellectual growth, in creating a supportive and empowering work environment that encourages discretionary behaviors. This finding is consistent with previous research that has established the positive influence of transformational leadership on employee outcomes[20,21]. However, this review contributes to the literature by exploring how transformational leadership practices can be tailored to meet the unique needs and preferences of Gen-Z. The emphasis on collaborative and inclusive leadership styles, as well as the importance of modeling OCB behaviors, provides practical insights for organizations seeking to develop effective leadership strategies for this generation.

In addition to transformational leadership, the review highlights the importance of effective coaching and feedback in enhancing OCB among Gen-Z employees. This finding aligns with previous research that has demonstrated the positive impact of coaching and feedback on employee performance and engagement[22,23]. However, the present review extends the current understanding by examining the specific preferences and expectations of Gen-Z employees regarding coaching and feedback. The findings suggest that Gen-Z employees value regular, constructive feedback and personalized coaching that focuses on their professional development and growth. Organizations may need to adapt their performance management practices to incorporate more frequent, technology-mediated feedback channels and

provide targeted coaching sessions that align with Gen-Z's career aspirations and learning preferences. The review also explores the potential of technological interventions, such as gamification and digital platforms, in promoting OCB among Gen-Z employees. This finding is particularly relevant in the context of the modern workplace, where technology plays an increasingly central role in shaping employee experiences and interactions. While previous studies have investigated the use of gamification in various organizational contexts [16,24], this review contributes to the literature by examining its specific application in fostering OCB among Gen-Z employees. The findings suggest that well-designed gamification techniques, such as leaderboards, badges, and challenges, can tap into Gen-Z's competitive spirit and desire for recognition, ultimately motivating them to engage in discretionary behaviors. However, the review also highlights the importance of ensuring that gamified platforms are inclusive, accessible, and aligned with organizational values and goals.

Despite the potential benefits of these strategies, the review also acknowledges the challenges and limitations associated with their implementation. For instance, while transformational leadership can be effective in promoting OCB among Gen-Z employees, organizations must be cautious of adopting an overly authoritative or charismatic leadership style, as it may be met with skepticism by this generation. Similarly, while technology can facilitate communication and collaboration, organizations must be mindful of the potential risks of over-reliance on digital platforms, such as information overload, digital fatigue, and the erosion of face-to-face interactions. These findings underscore the need for organizations to carefully consider the nuances and complexities involved in implementing these strategies and to adopt a balanced approach that takes into account the unique characteristics and preferences of Gen-Z employees. Moreover, the review identifies several areas for future research that can further advance our understanding of OCB in the context of Gen-Z employees. For instance, empirical investigations into the specific dimensions of OCB that resonate with Gen-Z, such as altruism, conscientiousness, and civic virtue, can provide valuable insights into the behaviors that are most likely to be exhibited by this generation. Additionally, future research could explore the potential moderating or mediating factors that may influence the relationship between OCB and Gen-Z employee outcomes, such as organizational culture, leadership styles, and HR practices. The development and evaluation of targeted interventions and strategies specifically designed to promote OCB among Gen-Z employees is another promising avenue for future research. By addressing these research gaps, scholars can provide organizations with evidence-based insights and practical recommendations for cultivating OCB and effectively integrating Gen-Z employees into the modern workplace.

Overall, this comprehensive review contributes to the existing body of knowledge by providing a focused examination of OCB in the context of Gen-Z employees. The findings offer valuable insights and practical recommendations for organizations seeking to foster OCB and effectively prepare this emerging generation for the challenges and opportunities of the modern workplace. By creating an inclusive and supportive organizational culture, adopting transformational leadership practices, providing effective coaching and feedback, and leveraging technology, organizations can tap into the unique strengths and potential of Gen-Z employees and create a mutually beneficial work environment that promotes discretionary behaviors and organizational success. However, the review also highlights the need for further research to deepen our understanding of OCB among Gen-Z employees and to inform evidence-based practices that can support the success of both individuals and organizations in the modern era. As Gen-Z continues to shape the future of work, it is crucial for organizations to proactively adapt their strategies and practices to effectively harness the potential of this diverse and dynamic generation.

## 5 CONCLUSION

This article presents an extensive examination of Organizational Citizenship Behavior (OCB) and its significance in preparing Generation Z (Gen-Z) employees for the contemporary workplace. By comprehending the dimensions and theoretical underpinnings of OCB, organizations can adopt various strategies and interventions to cultivate OCB among Gen-Z employees, resulting in enhanced employee engagement, commitment, and performance. The paper emphasizes the critical role of fostering a supportive organizational culture, leveraging effective leadership practices, and harnessing technology to effectively promote OCB within the Gen-Z workforce. Ultimately, organizations that prioritize OCB among Gen-Z employees will position themselves for success in the modern era.

## COMPETING INTERESTS

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

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