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THE IMPACT OF GOVERNMENT POLICIES ON THE INTEGRATION OF MANUFACTURING AND LOGISTICS INDUSTRIES: BASED ON THE MEDIATING ROLE OF SUPPLY CHAIN COOPERATION EFFICIENCY AND INFRASTRUCTURE SUPPORT IN GUANGXI, CHINA

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Abstract

The deep integration and development of manufacturing and logistics industries is an urgent issue facing China's current economic development. This article is based on a literature review of four variables: government policies, the integration of manufacturing and logistics industries, supply chain cooperation efficiency, and infrastructure support. Six hypotheses about the relationship between the four variables are proposed, including four direct effect hypotheses and two intermediary effect hypotheses. The article constructs a model with government policies as independent variables and supply chain cooperation efficiency and infrastructure support as intermediary variables, A conceptual model with the integration of manufacturing and logistics industries as the dependent variable. Based on 388 sample data from Guangxi, China, a structural equation model was constructed using partial least squares method for confirmatory factor analysis. The results showed that the hypotheses of four direct effects and two mediating effects were supported. These studies confirm that government policies have a significant positive impact on the efficiency of supply chain cooperation and infrastructure support. Both supply chain cooperation efficiency and infrastructure support have a significant positive impact on the integration of Guangxi's manufacturing and logistics industries. At the same time, both supply chain cooperation efficiency and infrastructure support play a significant mediating role in the impact of government policies on the integration of Guangxi's manufacturing and logistics industries.

Keywords: Integration of Manufacturing and Logistics Industries, Government Policies, Supply Chain Cooperation Efficiency, Infrastructure Suppor.

1. INTRODUCTION

China's 14th Five Year Plan and 2035 Vision Outline propose to deeply implement the strategy of building a strong manufacturing country, achieve the modernization level of industrial and supply chains, and take the high-quality development of service manufacturing as the guide to promote the integrated development of productive service industries. At present, there are still some problems in China, such as insufficient linkage between manufacturing industry and logistics industry, insufficient elasticity of supply chain, and weak coordination of industrial chain, especially under the impact of the COVID-19 epidemic, which directly affect the stable operation of the industry and the normal order of production and life. Overall, there are still issues with the integration and development of China's manufacturing and logistics industries, such as insufficient level, scope, and depth of integration, which are not in line with the overall requirements of promoting the formation of a strong domestic market in China and building a modern economic system (Wang & Wang, 2022).

The logistics industry is an important component of modern service industry, a leading industry that promotes the transformation and development of the circulation industry, accelerates consumption upgrading, and plays an important guiding role in the transformation and upgrading of China's manufacturing industry. The integration and development of advanced manufacturing and logistics industries can not only enhance the core competitiveness of the manufacturing industry, but also an important way to promote the high-quality development of the logistics industry. It has irreplaceable economic value for the efficient operation of the internal and external dual circulation (Liu & Wang, 2022). The deep integration and development of manufacturing and logistics industries is of great significance for promoting the formation of a new development pattern of "dual circulation" and building a modern industrial chain and supply chain system (Liang, 2021). Strengthening the deep integration of manufacturing and logistics industries is of great significance for maintaining the stability of industrial and supply chains, promoting industrial transformation and upgrading, and accelerating the construction of a modern industrial system (Wang & Wang, 2022).

This article introduces factors such as government policies, supply chain cooperation efficiency, and infrastructure support, attempting to study their impact on the integration of manufacturing and logistics industries. The research questions include: 1) What is the effect of government policies on supply chain cooperation efficiency and infrastructure support? 2) Does the efficiency of supply chain cooperation and infrastructure support play a mediating role between government policies and the integration of manufacturing and logistics industries? 3) How to improve the integration of manufacturing and logistics industries?

The research objectives include: 1) exploring the impact of government policies on supply chain cooperation efficiency and infrastructure support; 2) Examine whether the efficiency of supply chain cooperation and infrastructure support play a mediating role between government policies and the integration of manufacturing and logistics industries; 3) Propose relevant suggestions for the integration of manufacturing and logistics industries.

2. LITERATURE REVIEW

2.1 Government policies, supply chain cooperation efficiency, and integration of manufacturing and logistics industries

Under policy intervention, the supply chain can effectively integrate suppliers, manufacturers, warehouses, and stores (Qrunfleh & Tarafdar, 2013). The policy of regional integration can significantly promote the efficiency of advanced manufacturing supply chain cooperation

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through industrial agglomeration, and the promotion effect on the efficiency of state-owned enterprise supply chain cooperation is most obvious (Yuan & Wang, 2022). Wang Jingmin found that government policies have a positive impact on the expected returns of each "chain owner" in the supply chain. An increase in expected returns can drive the formation of a willingness to cooperate in the port hinterland supply chain, thereby improving the efficiency of cooperation in the port hinterland supply chain (2021). From a micro perspective, government innovation incentive policies promote technological innovation in enterprises (Sun & Ye, 2023), and enterprise innovation strategies have a positive impact on the operational performance of enterprises and even the entire supply chain (Huang et al., 2021). Enterprise technological innovation can improve the efficiency of enterprises in various links, thereby improving the efficiency of the entire industrial supply chain, including supply chain cooperation efficiency (Ivanov et al., 2018).

The deep integration and development of manufacturing and logistics industries takes the linkage between the two industries as an opportunity, the logistics supply and demand relationship as the fundamental driving force, and value co creation as the goal to achieve the deep integration and development of manufacturing and logistics industries in the supply chain, industrial chain, and value chain. Gao Zhijun demonstrated from three dimensions: three chain sharing effect, three chain complementarity effect, and three chain synchronization effect that the three-dimensional synergy of supply chain, industrial chain, and value chain is an important driving force for the deep integration and innovative development of China's manufacturing and logistics industries (Gao et al., 2023).

Based on the above research, this article proposes the following assumptions:

H1: Government policies have a significant positive impact on the efficiency of supply chain cooperation.

H2: The efficiency of supply chain cooperation has a significant positive impact on the integration of manufacturing and logistics industries.

H3: The efficiency of supply chain cooperation plays an intermediary role between government policies and the integration of manufacturing and logistics industries.

2.2 Government policies, infrastructure support, and integration of manufacturing and logistics industries

The government has the responsibility to provide infrastructure and ensure the most needed final supply of infrastructure, but it does not mean that infrastructure must be invested and produced by the government. The government strengthens information guidance and guides infrastructure construction through policies and other means (Qian & Lu, 2004). Kong Fangxia et al. believe that the different policy advantages of different regions also affect the construction of new infrastructure and urban green development (Kong et al., 2022). Zhang Pengfei and Huang Yejing found that the political environment has a significant impact on infrastructure construction by studying the factors affecting the PPP cooperation model of infrastructure construction in countries along the Belt and Road in China (Zhang & Huang,

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2019). Geng Yingying (2021) found that financial and tax policies have the greatest impact on logistics infrastructure, followed by energy-saving and emission reduction policies.

As one of the types of logistics resources, infrastructure has a significant impact on the efficiency of the linkage between manufacturing and logistics industries (Y. Yang, 2017). In the process of deep integration between manufacturing and logistics industries, strengthening the linkage planning between manufacturing bases and logistics infrastructure construction can help strengthen the connection between manufacturing and logistics industries (Z. Liu & Chen, 2022). Sun Jiaqing believes that implementing personalized infrastructure construction based on the logistics demand characteristics of the manufacturing industry is beneficial for the logistics industry to respond to its logistics needs to the greatest extent possible and integrate into manufacturing processes to the greatest extent possible (Sun et al., 2021). Taking Jianyang City, Sichuan Province as an example, Yang Hong found that strengthening logistics infrastructure construction can promote industrial linkage (Yang, 2021).

Based on the above research, this article proposes the following assumptions:

H4: Government policies have a significant positive impact on infrastructure support.

H5: Infrastructure support has a significant positive impact on the integration of manufacturing and logistics industries.

H6: Infrastructure support plays a mediating role between government policies and the integration of manufacturing and logistics industries.

2.3 Research Framework

Based on the above six assumptions, this study established a conceptual model, as shown in Figure 1:

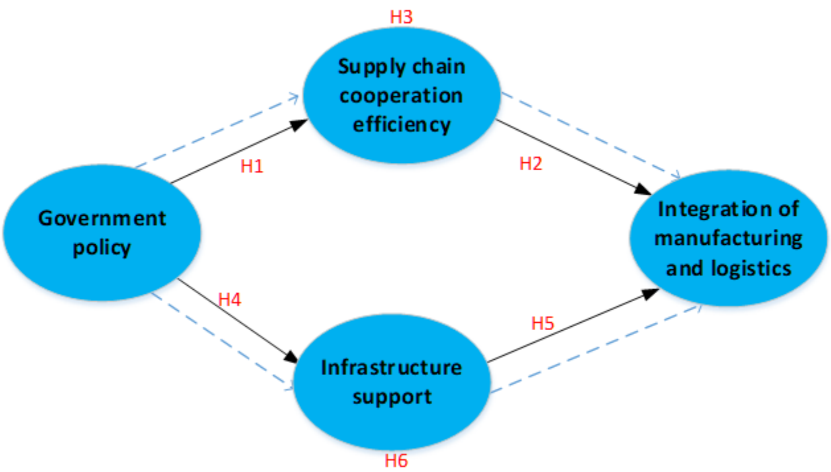

Figure 1: Conceptual Framework

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3. RESEARCH METHODOLOGY

3.1 Population and sample

The population of the study belongs to all employees of manufacturing or logistics enterprises within Guangxi Province, China, as well as all scientific researchers engaged in related research. Through online collection of questionnaire data, a total of 409 questionnaires were received. After deleting short response times and invalid questionnaires, 388 questionnaires were retained, with an effective rate of 94.8%.

3.2 Instrument

All variables were measured using the Likert 5-point scale method.

3.2.1 The scale about government policies

The measurement indicators are divided into three dimensions: Guiding and Propaganda Policy (GPP), Incentive Policy (GPE), and Industry Policy (GPI). The scale draws on the research results of many scholars, including Xue Xincheng (2022), Xing Xia (2021), Luo Xiangyun (2021), Chen Chengwen (2020), Jin Wanying (2022), Shaoying (2021), and Geng Huifang (2017) (C. Chen, 2020; H. Geng & Zhang, 2017; Jin & Liu, 2022; X) Luo & Yuan, 2021; Shao & Li, 2021; Xing & Xiu, 2021; Xue & Yao (2022), a total of 9 measurement items, including "The government's policy promotion on the integration of manufacturing and logistics can promote the integrated development of manufacturing and logistics" and "The government provides financial support or subsidies for the integrated development of manufacturing and logistics".

3.2.2 The scale about the integration of manufacturing and logistics industries

Drawing on the approach of Shu Huishan (2022), the measurement indicators divide the integration process of manufacturing and logistics into five dimensions: technology integration, product and service integration, market integration, organizational integration, and management integration, corresponding to five measurement items (Shu & Li, 2022). The specific items include "Technology integration can reflect the integrated operation of manufacturing and logistics" The integration of manufacturing products and logistics services can reflect the integrated operation of manufacturing and logistics industries.

3.2.3 The scale about supply chain cooperation efficiency

Drawing on Tan Tao's (2004) measurement method, the measurement indicators of supply chain cooperation efficiency are summarized as two dimensions: supply chain efficiency increase (SCEI) and supply chain cost reduction (SCCR) generated by supply chain cooperation, with a total of 9 measurement items (T. Tan & Wang, 2004). The specific items include "both parties can fulfill their respective responsibilities and commitments" and "cooperation with suppliers can increase the overall efficiency of the supply chain".

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3.2.4 The scale about infrastructure support

The measurement indicators are divided into two dimensions: Transportation Facility Support (TS) and Warehousing, Postal and Information Facility Support (WPIS). This scale is based on the research of Cynthia Sénquiz-Díaz (2021), Hu Jingyin (2022), Liu Man (2022), and others, with a total of 10 measurement items. Specific items such as "What do you think of the condition of highway transportation infrastructure in Guangxi?" and "Do you think Guangxi's warehouse facilities are complete?"

3.3 Data analysis

Construct a structural equation model using partial least squares method and perform confirmatory factor analysis using professional statistical analysis software. For the convenience of data analysis, this article encodes all latent variables, marking government policies as GP, supply chain cooperation efficiency as SCCE, infrastructure support as IS, and the integration of manufacturing and logistics as MALI.

4. RESULTS

4.1 Reliability and validity

The Cronbach alpha coefficients of all variables are greater than 0.7, and the combined reliability (CR) is greater than 0.7, indicating good internal consistency reliability of the data. The average variance extraction (AVE) of all variables is greater than 0.5, indicating good convergence validity of the data. These results are shown in Table 1.

The square root of AVE is greater than the corresponding correlation coefficient (Fornell and Larcker, 1981), and the majority of HTMT ratios are less than 0.9. At the same time, cross loadings show that the loadings of each item on this factor are greater than those on other factors, indicating good discriminant validity between variables.

Table 1: Reliability and Validity

Constructs	Items	Cronbach's alpha	Composite reliability	Average variance extracted (AVE)
GP	GPE	0.826	0.896	0.742
	GPI	0.842	0.905	0.76
	GPP	0.82	0.893	0.737
SCCE	SCCR	0.906	0.93	0.726
	SCEI	0.855	0.902	0.698
IS	TS	0.899	0.925	0.713
	WPIS	0.918	0.938	0.753

4.2 Structural equation modelling assessment

4.2.1 Model fit R^2

The larger the square value of R for endogenous latent variables, the stronger their explanatory power. This study found that the square values of the three endogenous latent variables, namely supply chain cooperation efficiency, infrastructure support, and the integration of

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manufacturing and logistics, are 0.488, 0.16, and 0.237, respectively. The square value of R for supply chain cooperation efficiency is close to 0.5, indicating a relatively strong explanatory power. The explanatory power of the integration of manufacturing and logistics is moderate, while the explanatory power of infrastructure support is relatively weak.

4.2.2 Predictive relevance indicator Q^2

The square of Q represents the correlation between the explanatory predictions of exogenous and endogenous variables, generally between 0-1. If the square of Q is greater than 0, the model has predictive ability. If the square of Q is less than 0, it indicates no prediction. If the square of Q is between 0.02-0.13, it indicates small prediction. If it is between 0.13-0.26, it indicates average. If it is greater than 0.26, it indicates strong prediction. This study found that the Q squared values of the three endogenous latent variables of supply chain cooperation efficiency, infrastructure support, and the integration of manufacturing and logistics industries are 0.481, 0.151, and 0.161, respectively, all exceeding 0.13, indicating strong predictive ability.

4.2.3 Covariance diagnosis VIF

The diagnostic analysis of the covariance of the model was carried out, which shows that the VIF between the measured variables are all below 5, and the VIF between the latent variable factors are also below 5, which indicates that there is no covariance in the model.

4.2.4 Model fit SRMR

The SRMR in this study is 0.084, indicating that the model is acceptable.

4.3 Hypothesis test

The size and significance of path coefficients are used to evaluate the relationship between research hypotheses. When the sample data is standardized, the value of the path coefficient is between 1 and -1, and the closer the value is to 1, the more positive the correlation; The closer the value is to -1, the more negative the correlation is. By dividing the path coefficient by the standard deviation, the T-value can be further calculated. According to previous research by scholars, when the sample size of the study is greater than 30, the quartile of the normal distribution can serve as the critical value. When the T-value is greater than the critical value, it can be claimed that there is a significant level of significance at a certain level of error, and the critical value is usually 1.96 (significant). The values are usually 1.96 (significance level of 5%), 2.57 (significance level of 1%), and 3.29 (significance level of 0.1%) (Hair Jr et al., 2013). In this study, the path coefficient and T-value were calculated using Bootstrapping. The number of Bootstrap cases is set to 5000 for calculating path coefficients and T-values. The path coefficients of the structural model in this study are shown in Figure 2.

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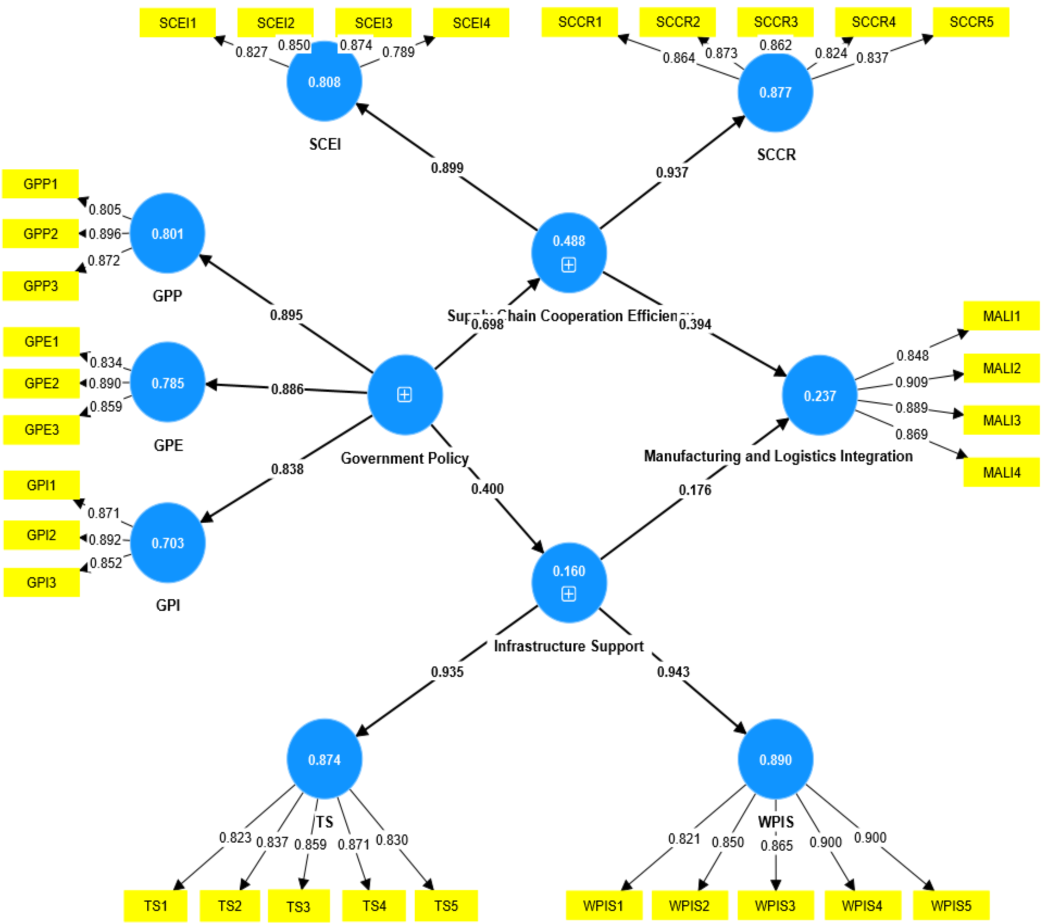

Figure 2: Structural Equation Model

4.3.1 Direct effect test

This article uses the Bootstrapping method to perform hypothesis testing, which uses a 95% bias corrected confidence interval and 5000 repetitions. The results of the direct path coefficient, T-value, and significance probability value are shown in Table 2. According to Table 2, the significance probabilities of all direct effect tests are less than 0.01, indicating that all hypotheses H1, H2, H4, and H5 related to direct effects in the structural equation model constructed in this paper have been validated.

Table 2: Hypothesis test results for direct effects

Path	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
GP -> IS	0.4	0.4	0.049	8.223	0
GP -> SCCE	0.698	0.698	0.035	19.768	0
IS -> MALI	0.176	0.178	0.049	3.599	0
SCCE -> MALI	0.394	0.395	0.051	7.684	0

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4.3.2 Mediation Effect Test

The hypothesis H3 and H6 for two mediating effects were proposed earlier in this article. The corresponding path coefficients, T-values, and significance probability values calculated using the Bootstrapping method are shown in Table 3. According to Table 3, both H3 and H6 passed the significance test at a significance level of 0.01.

Table 3: Hypothesis test results of mediating effects

Path	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
GP -> SCCE-> MALI	0.275	0.276	0.039	7.016	0
GP -> IS-> MALI	0.07	0.071	0.022	3.167	0.002

5. CONCLUSION AND DISCUSSION

5.1 Conclusion

This article takes government policy as the independent variable, supply chain cooperation efficiency and infrastructure support as the mediating variables, and the integration of manufacturing and logistics as the dependent variable. By reviewing relevant literature on the four variables mentioned above, six hypotheses about the relationship between the four variables are proposed, and a conceptual model about the relationship between the four variables is constructed. Then, based on 388 sample data from Guangxi Province, China, a structural equation model was constructed using partial least squares method and confirmatory factor analysis was performed. The research results show that all six hypotheses mentioned above are supported at a significance level of 0.01. This indicates that from the perspective of Guangxi, China, government policies have a significant positive impact on supply chain cooperation efficiency and infrastructure support. Both supply chain cooperation efficiency and infrastructure support have a significant positive impact on the integration of Guangxi's manufacturing and logistics industries. At the same time, both supply chain cooperation efficiency and infrastructure support play a significant mediating role in the impact of government policies on the integration of Guangxi's manufacturing and logistics industries.

5.2 Discussion

The research results indicate that government policies have a significant positive impact on the efficiency of supply chain cooperation and the integration of manufacturing and logistics industries. This emphasizes that the government should attach importance to supporting supply chain cooperation and industrial chain integration when formulating policies. The efficiency of supply chain cooperation has a positive impact on the integration of manufacturing and logistics industries, indicating that enterprises and governments may promote better collaboration of the entire industry chain when promoting the improvement of supply chain cooperation efficiency. The government should better play a guiding role in infrastructure construction and support for the synergy between manufacturing and logistics industries. The positive impact of infrastructure support on the integration of manufacturing

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and logistics industries emphasizes the importance of maintaining and improving infrastructure levels.

Overall, the above suggestions emphasize the important relationship between government policies, supply chain cooperation efficiency, infrastructure support, and the integration of manufacturing and logistics industries, providing insights for policy makers, enterprises, and researchers to promote the coordinated development of industrial chains.

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