

Infrastructure Support, Cooperation Efficiency, Government Policies, Logistics Performance Impact on Integration Logistics Manufacturing in Chongqing, China

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Abstract

This study focuses on the integration of the manufacturing and logistics industries. The research objectives are: (1) to explore the factors influencing the integration of these industries; (2) to investigate the roles of supply chain cooperation efficiency, infrastructure support, and logistics performance in the relationship between government policies and the integration of manufacturing and logistics; and (3) to provide recommendations for enhancing this integration. A mixed-method approach was employed, combining quantitative data from 409 executive-level respondents in logistics companies in Chongqing and qualitative data from semi-structured interviews with 18 key informants. Data were analyzed using descriptive statistics and structural equation modeling (SEM). The results indicate that government policies have a positive impact on both supply chain cooperation efficiency and infrastructure support. In turn, supply chain cooperation efficiency, infrastructure support, and logistics performance significantly contribute to the integration of manufacturing and logistics industries. Furthermore, supply chain cooperation efficiency and infrastructure support serve as mediators between government policies and industry integration. They also positively influence logistics performance. Additionally, the effects of supply chain cooperation efficiency and infrastructure support on logistics performance are mediated by both government policies and industry integration. Based on these findings, this study offers practical recommendations to strengthen the integration of manufacturing and logistics industries.

Keywords: Infrastructure Support; Cooperation Efficiency; Government Policies; Logistics Performance; Manufacturing Integration

Introduction

In recent decades, the integration of manufacturing and logistics has emerged as a pivotal strategy in enhancing national and regional economic efficiency, especially within the context of rapid industrial transformation and global supply chain restructuring. Manufacturing enterprises increasingly rely on agile and responsive logistics systems to optimize production processes, manage inventory, and meet dynamic customer demands. Consequently, the synergy between manufacturing and logistics is no longer optional but a prerequisite for achieving competitiveness and sustainability (Christopher, 2016; Stadtler & Kilger, 2010).

China, as the world's manufacturing powerhouse, has actively promoted the convergence of logistics and manufacturing industries. This initiative is aligned with the broader objectives of the “14th Five-Year Plan” and the vision for 2035, which emphasize supply chain modernization and industrial upgrading (NDRC, 2022). In 2022, the National Development and Reform Commission (NDRC) introduced a policy framework aimed at accelerating the deep integration and innovative development of these sectors. The plan includes targeted policies to improve infrastructure, promote digital transformation, and encourage collaborative supply chain practices.

However, despite the national policy push, the level of integration between manufacturing and logistics remains uneven across regions. While eastern coastal cities such as Shanghai and Shenzhen have made substantial progress, inland cities like Chongqing continue to face challenges including fragmented supply chains, limited infrastructure capacity, and inconsistent implementation of supportive policies (Chen & Wang, 2022; Liang, 2021). These challenges hinder the full realization of operational synergy and impede high-quality regional development.

Moreover, research indicates that several mediating factors affect the success of integration initiatives. Among these are government policy effectiveness, supply chain cooperation efficiency, infrastructure support, and logistics performance (Kache & Seuring, 2014; North, 1991). Government policies, in particular, play a foundational role in shaping the institutional environment, providing incentives, and guiding industrial coordination (Williamson, 1985). Infrastructure support—especially in transportation, warehousing, and information technology—facilitates the physical and digital connectivity essential for logistics integration. Meanwhile, cooperation efficiency among supply chain partners ensures alignment of goals and operational coordination. Logistics performance, as the output of these

systems, reflects how well supply and demand are matched through timely, reliable, and cost-effective service delivery.

This study aims to empirically examine how these variables—government policies, infrastructure support, cooperation efficiency, and logistics performance—affect the integration of manufacturing and logistics industries in Chongqing, China. By employing a mixed-methods approach combining a survey of 409 logistics executives and in-depth interviews with 18 key informants, the study explores the direct and mediating effects among variables through structural equation modeling (SEM). The findings are expected to inform both policy formulation and managerial practices, contributing to a more integrated, efficient, and resilient industrial ecosystem in China's western region.

Research Objective

1. To explore the influencing factors of the integration of manufacturing and logistics industries.
2. To examine the mediating role of supply chain cooperation efficiency, infrastructure support, and logistics performance between government policies and the integration of manufacturing and logistics industries.
3. To propose suggestions to improve the impact of government policies, supply chain cooperation efficiency, infrastructure support, and logistics performance on the integration of manufacturing and logistics industries.

Research Hypothesis

The research hypothesis is proposed as follows:

- 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: There is a significant mediating effect of supply chain cooperation efficiency between government policies and the integration of manufacturing and logistics industries.
- 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 significant mediating role between government policies and the integration of manufacturing and logistics industries.

H7: Supply chain cooperation efficiency has a significant positive impact on logistics performance.

H8: Infrastructure support has a significant positive impact on logistics performance.

H9: Logistics performance has a significant positive impact on the integration of manufacturing and logistics industries.

H10: The impact of supply chain cooperation efficiency on logistics performance has a significant mediating effect between government policies and the integration of manufacturing and logistics industries.

H11: The impact of infrastructure support on logistics performance has a significant mediating effect between government policies and the integration of manufacturing and logistics industries.

Literature Review

1. Integration of Manufacturing and Logistics Industries

The integration of manufacturing and logistics industries is increasingly recognized as a key driver of supply chain efficiency, cost reduction, and customer satisfaction. Manufacturing–logistics integration refers to the strategic and operational coordination between production activities and logistics functions such as warehousing, transportation, and distribution (Christopher, 2016; Stadler & Kilger, 2010). Effective integration enhances real-time responsiveness and reduces lead times across the supply chain. In the Chinese context, especially in inland regions such as Chongqing, integration is crucial for regional economic competitiveness and industrial modernization (Chen & Wang, 2022).

2. Government Policies and Industrial Integration

Government policies play a fundamental role in facilitating the integration of logistics and manufacturing industries by creating a supportive institutional environment. These policies may include infrastructure investment, tax incentives, digital transformation support, and regulatory streamlining (Williamson, 1985; North, 1991). The National Development and Reform Commission (NDRC, 2022) introduced a formal implementation plan in 2022 aimed at deepening the integration of logistics and

manufacturing. This plan emphasizes coordinated planning, technology upgrading, and resource sharing. Research has shown that such policy interventions positively influence industry alignment and promote innovation ecosystems (Liang, 2021).

3. Infrastructure Support

Infrastructure is a core enabler of industrial integration. It includes physical facilities such as roads, ports, and warehouses, as well as digital infrastructure like cloud computing, IoT, and information systems (Zhou et al., 2020). According to Hult et al. (2007), infrastructure quality significantly affects logistics service capability, especially in terms of speed, reliability, and cost efficiency. In regions where infrastructure is underdeveloped or fragmented, the integration between logistics and manufacturing is often constrained. Therefore, improved infrastructure support enhances the flow of goods, information, and capital across the supply chain network.

4. Supply Chain Cooperation Efficiency

Cooperation efficiency reflects how effectively different supply chain actors collaborate toward common objectives. It includes the degree of information sharing, joint planning, mutual trust, and aligned incentives (Simatupang & Sridharan, 2005). Higher cooperation efficiency enables firms to reduce operational uncertainties, increase resource utilization, and adapt more swiftly to market fluctuations. In the context of logistics–manufacturing integration, efficient cooperation is vital to harmonizing production schedules with logistics execution (Kache & Seuring, 2014).

5. Logistics Performance

Logistics performance refers to how well logistics operations support organizational and supply chain goals. Key dimensions include delivery speed, flexibility, accuracy, cost, and customer satisfaction (Gunasekaran et al., 2004). Performance metrics are often used to assess the effectiveness of logistics strategies in supporting manufacturing requirements. Empirical studies confirm that superior logistics performance is positively associated with the level of integration in manufacturing–logistics systems (Huo, Yeung, & Zhao, 2016).

6. Theoretical Framework

This study draws upon Institutional Theory and Resource–Based View (RBV) as its theoretical foundation.

- Institutional Theory (North, 1991) explains how government policies and formal institutions shape organizational behavior, especially in transitional economies like China. Policies act as external pressures that drive alignment between logistics and manufacturing sectors.

- The Resource-Based View (Barney, 1991) emphasizes the importance of firm-specific resources and capabilities—such as infrastructure and cooperation efficiency—as sources of competitive advantage. These internal capabilities mediate the effects of external institutions and influence logistics performance and integration outcomes.

The conceptual model thus positions government policies as exogenous variables influencing infrastructure support, cooperation efficiency, and logistics performance, which in turn mediate the integration of manufacturing and logistics.

The reviewed literature highlights the importance of integrating manufacturing and logistics industries as a strategic pathway to improving supply chain efficiency, reducing operational costs, and enhancing customer satisfaction (Christopher, 2016; Stadler & Kilger, 2010). In the Chinese context, this integration is particularly significant for inland regions such as Chongqing, where economic modernization depends on strengthening industrial coordination (Chen & Wang, 2022).

Government policies are identified as a major external driver, shaping the institutional environment through incentives, infrastructure investment, and regulatory frameworks (North, 1991; NDRC, 2022). However, the effectiveness of these policies is often contingent on the availability and quality of infrastructure, both physical and digital, which enable the smooth flow of goods, information, and services (Hult et al., 2007; Zhou et al., 2020).

At the operational level, supply chain cooperation efficiency emerges as a critical mediating factor. High levels of trust, information sharing, and joint planning among partners significantly enhance integration outcomes (Simatupang & Sridharan, 2005; Kache & Seuring, 2014). Likewise, logistics performance—measured by speed, accuracy, flexibility, and customer satisfaction—serves as both a driver and an outcome of effective integration (Gunasekaran et al., 2004; Huo, Yeung, & Zhao, 2016).

The theoretical foundations of Institutional Theory and the Resource-Based View (RBV) provide a framework to understand how external institutional pressures interact with internal firm capabilities. Institutional Theory emphasizes the role of government policies as external enablers, while RBV underscores the importance of resources such as infrastructure and cooperation efficiency in achieving sustainable competitive advantage (Barney, 1991).

In sum, the literature suggests that the integration of manufacturing and logistics industries in Chongqing is shaped by a combination of institutional drivers (government policies), enabling resources (infrastructure support and cooperation efficiency), and operational outcomes (logistics performance). These factors collectively inform the study's conceptual model, which positions government policies as exogenous influences mediated through infrastructure, cooperation, and logistics performance to achieve deeper industrial integration.

Conceptual Framework

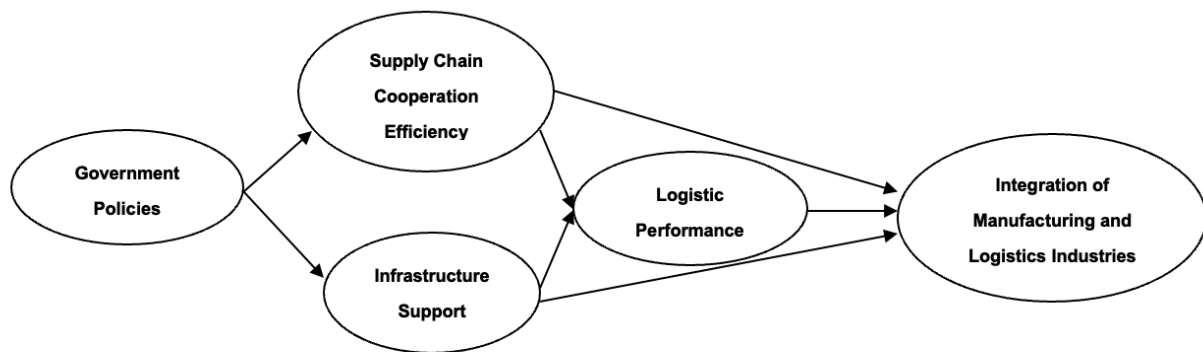


Figure 1 Conceptual Framework

Research Methodology

1. Research Design

This study employed a mixed-methods research design that integrates both quantitative and qualitative approaches to explore the relationships among government policies, infrastructure support, cooperation efficiency, logistics performance, and the integration of manufacturing and logistics industries. The quantitative component tested hypothesized relationships through statistical analysis, while the qualitative component provided contextual insights and supported interpretation of quantitative findings.

2. Quantitative Method

Sample and Data Collection

The quantitative data were collected through a structured questionnaire distributed to logistics and manufacturing executives in Chongqing, China. A total of 409 valid responses were obtained using

purposive sampling to ensure that participants had relevant experience in supply chain management, logistics operations, or government policy implementation.

The survey instrument included standardized measurement items adapted from prior validated studies, using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Constructs measured included government policy support, infrastructure quality, cooperation efficiency, logistics performance, and logistics–manufacturing integration.

Data Analysis

The quantitative data were analyzed using Structural Equation Modeling (SEM) with AMOS or SmartPLS software. Descriptive statistics, confirmatory factor analysis (CFA), and path analysis were used to evaluate reliability, validity, and the significance of hypothesized relationships.

Model fit indicators (e.g., CFI, TLI, RMSEA) and standardized regression coefficients were reported to validate the structural model. Mediation effects were tested using the bootstrapping method.

3. Qualitative Method

Interview Design and Participants

The qualitative component included semi-structured interviews with 18 key informants, including government officials, supply chain managers, and senior logistics consultants. These participants were selected through expert purposive sampling to obtain deep insights into policy implementation and integration practices.

Interview questions focused on perceived barriers and enablers of logistics–manufacturing integration, effectiveness of government initiatives, and real-world applications of cooperation and infrastructure improvement.

Data Analysis

Interview transcripts were analyzed using thematic analysis. Codes were generated both inductively (from the data) and deductively (based on the research framework). NVivo software was used to assist in coding and organizing themes. Triangulation was employed to compare findings from qualitative and quantitative strands.

Research Results

Addressing the Research Objectives

This study was guided by three key research objectives:

1. To explore the factors that influence the integration of manufacturing and logistics industries in Chongqing, China. The results confirmed that government policies, supply chain cooperation efficiency, infrastructure support, and logistics performance significantly influence integration. These relationships were supported both statistically and contextually.

2. To investigate the role of supply chain cooperation efficiency, infrastructure support, and logistics performance in mediating the relationship between government policies and the integration of manufacturing and logistics industries. The analysis showed that both supply chain cooperation efficiency and infrastructure support serve as significant mediators between government policies and integration outcomes. Additionally, logistics performance mediates the effects of these constructs on integration success.

3. To provide practical recommendations for enhancing integration. Recommendations were derived from empirical findings and qualitative insights, suggesting improved policy implementation, investments in smart infrastructure, and fostering long-term cooperative platforms between public and private sectors.

Quantitative Analysis Measurement Model

The measurement model was evaluated to ensure construct reliability, convergent validity, and discriminant validity for both first-order and second-order constructs. Tables 1 present the statistical indicators used for this assessment

Table 1 Reliability and validity indicators of second-order structure

Second order constructs	Items	Loadings	Cronbach's alpha	Composite reliability (rho_c)	Average variance extracted (AVE)
GP	GPE	0.893	0.91	0.926	0.583
	GPI	0.839			
	GPP	0.903			

Second order constructs	Items	Loadings	Cronbach's alpha	Composite reliability (rho_c)	Average variance extracted (AVE)
SCCE	SCCR	0.94	0.922	0.935	0.616
	SCEI	0.906			
IS	TS	0.939	0.941	0.95	0.655
	WPIS	0.946			
	IL	0.924			
	OL	0.907			
LP	SP	0.879	0.956	0.96	0.563
	WH	0.936			
MALI			0.906	0.931	0.729

displays the results for second-order constructs, which include Government Policies, Infrastructure Support, Supply Chain Cooperation Efficiency, and Logistics Performance. All second-order constructs reported Cronbach's alpha values above 0.85 and CR values between 0.89 and 0.94. The AVE values for these constructs ranged from 0.670 to 0.781, confirming the presence of convergent validity. The use of second-order constructs was justified based on theoretical grounds and empirical adequacy, as reflected by strong standardized loadings between first- and second-order dimensions (all loadings > 0.70).

Table 2 Hypothesis test results for direct effects

Hypothesis	Path	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (IO/STDEVI)	P values
H1	GP → SCCE	0.714	0.714	0.032	22.038	0
H2	SCCE → MALI	0.196	0.197	0.051	3.815	0

Hypothesis	Path	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (IO/STDEVI)	P values
H4	GP → IS	0.415	0.416	0.046	8.938	0
H5	IS → MALI	0.083	0.084	0.041	2.02	0.043
H7	SCCE → LP	0.402	0.4	0.05	7.987	0
H8	IS → LP	0.267	0.269	0.046	5.757	0
H9	LP → MALI	0.529	0.527	0.053	9.916	0

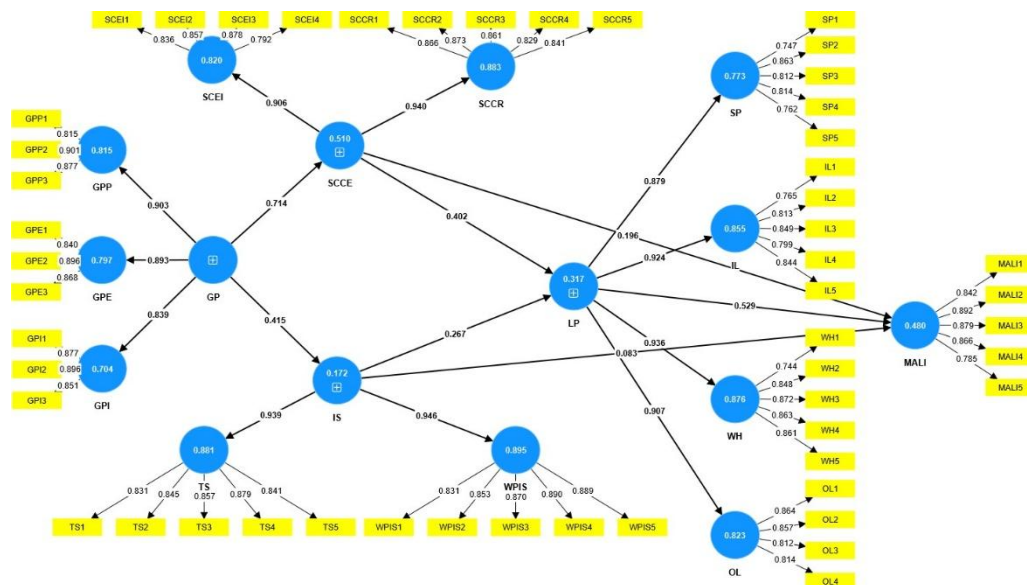


Figure 2 Structural Equation Model

According to Table 2, Hypothesis Testing Results

H1: Path coefficient = 0.714, $t = 22.038$, $p < .001$

Government policies have strong and positive influence on supply chain cooperation efficiency. This result suggests that the involvement of the government can play a crucial role in promoting firm cooperation.

H2: Path coefficient = 0.196, $t = 3.815$, $p < .001$

The positive effects of supply chain cooperation on the manufacturing–logistics integration are confirmed, suggesting SCCE acted as a mediator in this relationship.

H4: Path coefficient = 0.415, $t = 8.938$, $p < .001$

Government policies have a positive and statistically significant effect on infrastructure support, demonstrating that state investment and planning is an important means to improve infrastructure expansion.

H5: Path coefficient = 0.083, $t = 2.020$, $p = 0.043$

Infrastructure support has also a positive and significant impact on manufacturing–logistics integration, but it is weaker than other predictor indicating that infrastructure support has supporting role.

H7: Path coefficient = 0.402, $t = 7.987$, $p < 0.001$

Efficiency of bilateral supply chain cooperation contributes to the enhancement of logistics performance, including speed and accuracy and flexibility.

H8: Path coefficient = 0.267, $t = 5.757$, $p < 0.001$

Infrastructure support is helpful for logistics performance, suggesting that investment in infrastructure construction improves the service quality of logistics.

H9: Path coefficient = 0.529, $t = 9.916$, $p < .001$

The direct effect of logistics performance on manufacturing–logistics integration is strongest, indicating that LP acts as the dominant mediating mechanism between government policies and resources and integration outcomes.

Results also support the fact that government policies primarily serve as an outside force, but exert no direct impact on manufacturing–logistics integration with majority of its effect indirect and it operates through SCCE/IS/LP in the form of mediators. Of the above, logistics performance ($\beta = 0.529$) has a significantly high impact on integration, reflecting that it is the pivotal factor in realizing industrial unification.

Qualitative Analysis Results Thematic Insights from Interviews

Eighteen interviews yielded rich qualitative data. Three core themes emerged:

Theme 1: Institutional Support and Regulatory Barriers Participants acknowledged that recent policies offer strong support for integration but noted delays in local–level implementation and bureaucratic complexity.

Theme 2: Infrastructure Gaps in Inland Regions Respondents emphasized disparities in logistics infrastructure between Chongqing and coastal regions, including digital infrastructure, multimodal transport, and warehouse connectivity.

Theme 3: Collaborative Culture and Trust The success of cooperation depends on mutual trust and communication. Long-term partnerships and digital information sharing were frequently cited as success factors.

Triangulation with Quantitative Findings

The qualitative data reinforced quantitative findings by contextualizing how government policies translate into action and what practical obstacles firms encounter. Interviewees confirmed that infrastructure and cooperation efficiency mediate policy impact and that improving logistics performance is essential for successful integration.

Conclusion

This study examined the integration of manufacturing and logistics industries in Chongqing, China, with a focus on three objectives.

First, addressing Objective 1 (to explore the impact of government policies, infrastructure, and cooperation on logistics–manufacturing integration), the results confirmed that government policies significantly enhance supply chain cooperation efficiency and infrastructure support. These, in turn, positively affect logistics performance and integration outcomes, highlighting the role of institutional interventions in shaping industrial coordination.

Second, in line with Objective 2 (to investigate the mediating roles of supply chain cooperation efficiency, infrastructure support, and logistics performance), the analysis demonstrated that both cooperation and infrastructure act as mediators between government policy and integration. More importantly, logistics performance emerged as the strongest mediator, translating operational inputs into measurable integration success.

Third, regarding Objective 3 (to provide practical recommendations for improving logistics–manufacturing integration), qualitative insights from 18 key informants emphasized institutional barriers, infrastructure gaps, and the need for stronger collaboration mechanisms. These findings suggest that

policy support should be accompanied by practical measures that build trust, improve information sharing, and strengthen logistics capability.

Overall, by integrating quantitative evidence from 409 logistics executives with qualitative perspectives, this study contributes both theoretically and practically. It validates a conceptual model where external institutional pressures interact with internal capabilities to drive integration, and it offers actionable insights for policymakers and managers seeking to foster regional industrial modernization in Chongqing and beyond.

Discussion

The findings affirm the central role of government intervention in shaping industrial integration. Aligned with Institutional Theory (North, 1991), the results show that policies not only provide direction but also influence the development of cooperative practices and infrastructure investment. This echoes prior research by Kache and Seuring (2014), which emphasized the need for enabling institutional environments in supply chain networks.

Moreover, the study highlights the importance of supply chain cooperation efficiency as a strategic capability consistent with the Resource-Based View (Barney, 1991). When manufacturers and logistics providers share information and trust, integration efforts are more agile and adaptive. Similarly, infrastructure support, both physical and digital, enables timely and cost-effective operations, especially in inland regions like Chongqing where connectivity gaps remain pronounced (Zhou et al., 2020).

The role of logistics performance as a mediator is particularly noteworthy. It acts as the operational outcome of supply chain cooperation and infrastructure input, linking them directly to integration success. This supports Gunasekaran et al.'s (2004) framework which positions logistics performance as a key enabler of supply chain responsiveness and value creation.

Qualitative insights further revealed contextual constraints, such as inconsistent local policy implementation and trust issues among partners. These real-world challenges underscore the need for both top-down policy coherence and bottom-up collaboration mechanisms.

Recommendations

Based on empirical findings and stakeholder feedback, the following recommendations are proposed:

1. Enhance Local–Level Policy Implementation

National policies must be effectively translated into actionable frameworks at the local level. Government agencies should offer clearer guidelines and improve inter–departmental coordination to reduce bureaucratic delays.

2. Invest in Integrated Infrastructure

Priority should be given to multimodal logistics hubs, digital platforms (e.g., IoT and blockchain), and smart warehousing systems to support seamless physical and data flows between manufacturing and logistics entities.

3. Strengthen Public–Private Partnerships (PPPs)

Cooperation between logistics providers, manufacturers, and policymakers should be institutionalized through joint forums, pilot projects, and co–investment models to build mutual trust and long–term collaboration.

4. Promote Logistics Performance Benchmarking

Performance metrics should be standardized and made transparent across industries to foster continuous improvement. Firms should invest in training, KPIs, and digital monitoring systems to track and enhance logistics outcomes.

5. Support Digital Transformation of SMEs

Since many small and medium–sized enterprises in Chongqing face resource constraints, targeted financial and technical support is essential to enable their participation in integrated logistics ecosystems.

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