International Journal of Research Studies in Management
2025 Volume 13 Number 6, 249-262

Enterprise information system, warehouse management and integrated transportation system: Basis for logistics' innovation framework

Zhang, Qiaoning ✉
Graduate School, Lyceum of the Philippines University - Batangas, Philippines

ISSN: 2243-7770
Online ISSN: 2243-7789

Received: 15 July 2025 **Revised**: 27 August 2025 **Accepted**: 31 August 2025 OPEN ACCESS
Available Online: 7 September 2025 **DOI**: 10.5861/ijrsm.2025.25094

Abstract

The study aimed to examine the enterprise information system, warehouse management, and integrated transportation system among logistics companies in China as the basis for developing a logistics innovation framework. The study employed a descriptive quantitative research design. Data were collected through questionnaires. The questionnaire comprised five parts covering individual and enterprise characteristics as well as evaluations of the three systems. The study randomly sampled 600 employees from various logistics companies in Bozhou City, China. The findings revealed a moderate level of enterprise information system performance, with respondents generally agreeing that the operational, tactical, and strategic systems performed well. Additionally, the warehouse management practices were rated positively in terms of layout, equipment, and manpower management, indicating effective resource utilization and operational efficiency. The transport system practices were also moderately rated, particularly in route management, fleet management, and technology investment, which supported better transportation efficiency and cost reduction. Furthermore, the study found a highly significant positive correlation among the enterprise information system, warehouse management, and integrated transportation system, emphasizing the interdependence of these components in enhancing overall logistics performance. These results underscored the importance of continuous technology investment, robust manpower management, and effective data utilization in sustaining logistics operations. Based on the comprehensive analysis, the study developed a logistics innovation framework that provided a solid foundation for improving operational efficiency, reducing costs, and maintaining competitive advantage in a dynamic market environment.

Keywords: enterprise information system, warehouse management, integrated transportation system, logistics' innovation framework

Enterprise information system, warehouse management and integrated transportation system: Basis for logistics' innovation framework

1. Introduction

Enterprise Information system (EIS) functions to integrate the key enterprise processes of an enterprise, including financial management, human resources, supply chain, customer relationship management, etc., by providing a unified information platform to support the decision-making and daily operations of enterprises. This system utilizes advanced data processing and analysis technologies, such as big data analytics and artificial intelligence, to achieve higher operational efficiency and better strategic decision support (Wang, 2021). The Warehouse Management (WM) is the software system used to manage warehouse operations, which helps enterprises optimize the inventory storage, picking, packaging and delivery process. The WMS system can automate many tasks within the warehouse, reduce human error, and improve the accuracy and efficiency of the warehouse operations.

The Integrated Transportation System is a system involving multiple modes of transportation, which maximizes transportation efficiency by optimizing logistics routes, selection of transportation modes of transportation, and cargo scheduling. The key advantage of an integrated transport system is that it is able to minimize transportation costs and environmental impact while ensuring cargo delivery on time. These highly integrated information systems and management tools play a vital role in modern enterprises. With the continuous progress of technology, the ability of enterprise information system, warehouse management and integrated transportation system in realizing intelligence and automation is also constantly improving, further promoting the innovation and optimization of the global supply chain.

In recent years, China's enterprise information system, storage management and integrated transportation system have experienced rapid development and changes. For example, many manufacturing enterprises and retailers have deployed ERP (Enterprise Resource Planning) and CRM (Customer Relationship Management) systems, which integrate multiple enterprise functions from supply chain management to customer service to help enterprises automate and optimize enterprise processes (Li et al., 2020). In the field of warehouse management, intelligent and automation technology is becoming more and more widely used.

In addition, the introduction of Internet of Things (IoT) technology enables warehouse management to monitor inventory status and environmental conditions in real time, so as to achieve more efficient inventory control and risk management (Wang, 2023). In terms of integrated transportation systems, China is committed to building a more efficient and sustainable logistics network. By integrating multiple modes of transport, such as rail, road, water and aviation, as well as the adoption of advanced transport management software, Chinese companies are able to optimize the transport routes and scheduling plans of goods, effectively reduce logistics costs and improve transport efficiency (Senne et al., 2021). In particular, under the Belt and Road initiative, transnational and trans-regional logistics services have been greatly developed, enhancing the competitiveness of Chinese enterprises in international trade. Despite the remarkable achievements, China still faces some challenges in the development of enterprise information systems, warehouse management and integrated transportation systems, such as data security and privacy protection, the complexity of system integration, and the difficulties of cross-regional logistics coordination (Li, 2022). In the future, with further technological progress and the optimization of the policy environment, China is expected to continue to promote innovation and improvement in these areas to support the rapid changes in domestic and foreign market demand.

Enterprises in Bozhou area have made some progress in promoting the modernization of information system, warehouse management and comprehensive transportation system, but they still face many challenges. First of all, although the introduction of enterprise information system greatly enhances the ability of data processing and

analysis, and improves the efficiency of enterprise decision-making, the lack of integration between systems leads to serious data isolation, and low efficiency of data sharing and circulation between different departments and systems (Wang et al., 2022). This limits the potential of information systems to enhance overall enterprise collaboration and the ability to respond to market changes. In terms of warehouse management, despite the introduction of certain automation technologies, such as automated warehouse and intelligent sorting system, the overall warehouse space utilization efficiency still needs to be improved. In addition, the accuracy of inventory management also occurs frequently, which not only affects the timeliness and accuracy of logistics, but also may lead to excess or inventory shortage, which increases the operating costs of enterprises (Kong, 2022). In terms of transportation system, although Bozhou area has a superior geographical location, the infrastructure construction and cross-regional coordination mechanism are not perfect, which affects the efficiency and cost control of the comprehensive transportation system. Especially in the process of cross-regional transportation, due to the lack of effective logistics coordination and information sharing platform, it often leads to the waste of transportation resources and the unnecessary increase of transportation costs (Zhang, 2024). Therefore, the enterprises in Bozhou area need to further strengthen the integration of the information system, optimize the storage management process and improve the collaborative efficiency of the transportation system, so as to overcome the existing challenges and improve the overall efficiency of logistics and supply chain management.

At present, the research on information system, storage management and comprehensive transportation system mainly focuses on the theoretical discussion and the practical application of large cities or economically developed areas. For small and medium-sized cities with unique geographical location and economic characteristics like Bozhou, the related research is obviously insufficient. As a region in economic transformation, Bozhou faces many challenges in the application of information system, the modernization of storage management and the integration of transportation system, but also contains huge development potential. The reason for this selection to study Bozhou lies in its representativeness and strategy. As an inland city, the efficiency of Bozhou's logistics system and supply chain management directly affects the commercial activities and economic development of the local and surrounding areas. Through the in-depth analysis of the enterprise information system, warehouse management and comprehensive transportation system in Bozhou, it can not only reveal the specific problems and challenges faced by the region in these fields, but also explore the solutions and strategies suitable for such cities, which has great theoretical and practical significance. In addition, this study can provide strategic advice for Bozhou and other regions with similar economic structure and development stage, and help the enterprises in these regions to optimize the information system, improve the efficiency of warehouse management and improve the comprehensive operation capacity of the transportation system. These research results can not only fill the gap in the existing literature, but also provide data support and decision-making basis for policy makers and enterprise decision-makers, and promote the healthy development of regional economy and industrial upgrading.

Objectives of the Study - The study aimed to examine the enterprise Information System, warehouse management and integrated transportation systems among logistics companies in China that will be the basis in developing a logistics innovation framework. Specifically, it will assess the enterprise information system as to operational system, tactical system, and strategic system; assess the warehouse management in terms of warehouse layout, warehouse equipment and warehouse manpower management; describe the the performance of transportation system practices as to route management, fleet management and technology investment; test the significant relationship among information system, warehouse management and integrated transportation systems and develop a logistics innovation framework.

2. Methods

Research Design - This study used descriptive quantitative research methods where data were collected through questionnaires. The first part of the study focused on collecting respondents' evaluations of the enterprise information system, exploring the technical implementation, operational efficiency, data security, and impact on decision support. The second part was on the evaluation of warehouse management, including the

level of automation, inventory accuracy, cost control, and flexibility. The third part focuses on the integrated transport system and assessing its performance in transport efficiency, cost savings, cargo tracking and customer service.

Participants of the Study - Participants were personnel of logistics enterprises located in Bozhou City, China, covering different positions from front-line operators to senior management. The study selected 600 employees by random sampling method to ensure the representativeness of the sample and the general applicability of the study results. As an area with active logistics and trade, Bozhou city has a variety of logistics enterprises, including domestic transportation companies, international freight forwarding, warehousing service providers and comprehensive logistics service providers, etc., which provides rich data sources and a wide perspective for research.

Instruments of the Study - The survey tool of this study is a specially designed questionnaire, designed to comprehensively collect the enterprise information system, warehouse management, and the use and evaluation of the integrated transportation system. The questionnaire is divided into five parts, systematically covering individual characteristics, enterprise characteristics and the evaluation of the three systems. The first part of the questionnaire focused on the respondents 'specific evaluation of the enterprise information system, asking them about their views on the system functionality, reliability, user-friendliness, technical support, and the system's contribution to the enterprise process improvement. Through this part of the data, research can reveal the efficiency and effectiveness of information systems in actual operation, and how they help enterprises to optimize the decision-making process and enhance competitiveness. The second part discusses the warehouse management systems, including the automation level, inventory management efficiency, cost control and error rate, so as to evaluate the actual performance of these systems in improving the storage operation efficiency and reducing costs. This section will also explore the flexibility and support for emergency management to adapt to the face of different storage needs and challenges. The fourth part of the questionnaire focuses on the evaluation of the integrated transport system, asking respondents about the integrated transport efficiency, cost-effectiveness, cargo tracking capability, and the quality of customer service. This section aims to evaluate the performance of an integrated transport system in actual transport operations, including how it deals with the complexity of transport and provides effective logistics solutions. Through these detailed survey data, the study were able to conduct an in-depth analysis of the comprehensive effect of the enterprise information system, storage management and comprehensive transportation system, and explore whether there are differences in the application effect of these systems in different types of enterprises. This provided a scientific basis for putting forward a feasible logistics innovation framework, and help enterprises to stay ahead in the fierce market competition. The questionnaire was subjected to validation of the experts and reliability test.

Table 1
Summary of Reliability Test

Indicators	No of Items	α value	Interpretation
Operating System	5	0.929	Excellent
Tactical System	5	0.904	Excellent
Strategic System	5	0.931	Excellent
Warehouse Layout	5	0.914	Excellent
Warehouse Equipment	5	0.931	Excellent
Warehouse Manpower Management	5	0.922	Excellent
Route Management	5	0.912	Excellent
Fllet Mangement	5	0.924	Excellent
Technology Investment	5	0.901	Excellent

George and Mallery (2003) provide the ff rules of thumb: _>.9– Excellent, _>.8–Good, _ >.7–Acceptable, _>.6–Questionable, _>.5–Poor, and _<.5–Unacceptable.

All indicators in the table, including Operating System (0.929), Tactical System (0.904), Strategic System (0.931), and others, have Cronbach's Alpha values above 0.9, which falls under the "Excellent" category. This showed that the items used to measure each indicator are highly reliable and internally consistent.

Data Gathering Procedure - The data collection steps for this study were systematically designed to ensure

that the information collected is accurate and comprehensive and can effectively support the answers to the research questions. The data collection process mainly includes the following key steps:

- Step 1: Design of the questionnaire. The researcher carefully designed the questionnaire based on the study objectives. At the same time, in order to ensure the validity and reliability of the questionnaire, the researcher conducted a pre-test, invite a small number of logistics enterprise employees to fill in and provide feedback, and adjust the questionnaire design according to the feedback.

- Step 2: Sample selection and sampling. After determining the sample framework, the investigators will select 600 employees from the logistics enterprises in Bozhou city as the research object. This process was conducted through the internal contacts of collaborative logistics enterprises or the membership list of industry associations, ensuring the representativeness and randomness of the sample.

- Step 3: Data collection and implementation. Data collection for this study was conducted through online questionnaire format for release and administered using professional questionnaire star platform. Respondents could fill out questionnaires on any connected device to improve recovery and engagement.

- Step 4: Data collation and preliminary analysis. After data collection, the investigator clean and initially analyze the data to exclude invalid or incomplete questionnaires. Data will be entered into the statistical software for descriptive statistical analysis to depict the basic characteristics of the sample and check the overall quality and distribution of the data.

- Step 5: Thorough analysis and report preparation. The investigators conducted a more thorough statistical analysis according to the research purpose, including variance analysis and regression analysis, to explore the impact of different enterprise characteristics on enterprise information system, warehouse management and integrated transportation system. The analysis results was used to write the research report and paper, and also provide data support for proposing a logistics innovation framework.

Data Analysis - Weighted mean and rank were used to assess the information system as to operational system, tactical system and strategic system; determine the warehouse management in terms of warehouse layout, warehouse equipment and warehouse manpower management; describe the transportation system as to route management, fleet management and technology investment. The result of Shapiro-Wilk Test showed that p-values of all variables were less than 0.05 which means that the data set is not normally distributed. Therefore, Spearman rho was used to test the significant relationship as part of the non-parametric tests. All analyzes were performed using SPSS version 28.

Ethical Considerations - In conducting this study, ethical considerations are essential to ensure that the ethical and legal responsibilities of the study are properly respected and observed. First, all participants sought consent before participating in the study, clarifying that their participation is voluntary and that they can withdraw from the study at any time without experiencing any adverse effects. The questionnaire guaranteed anonymity and confidentiality of the data, ensuring that participants' personal information is not leaked or used for purposes other than the study. In addition, all relevant data protection regulations to ensure that the process of collecting, storing, and processing data complies with national and international standards. Special attention was observed in the study to avoid any form of bias and discrimination, ensuring impartiality and objectivity in the data collection and analysis process. The investigator conducted a regular ethical review to ensure that every part of the study meets the ethical standards. Any research findings reported and discussed in a manner that respects and protects the rights and interests of the participants. Through these measures, research aimed to generate not only valuable academic and practical contributions, but also a deep understanding and commitment to participants and social responsibility.

3. Results and discussions

Table 2
Summary Table on Information System

Key Result Areas	Composite Mean	VI	Rank
Operational System	3.32	Agree	1
Tactical System	3.26	Agree	3
Strategic System	3.29	Agree	2
Grand Composite Mean	3.29	Agree	

Legend:3.50-4.00=Strongly Agree;2.50-3.49=Agree;1.50-2.49=Disagree;1.00-1.49=Strongly Disagree

The overall composite mean of the information system is 3.29, located within the "agree" range. This indicates that the respondents generally recognized the effectiveness and role of corporate information systems as a whole. The comprehensive average reflects the overall performance of information systems in the three key areas of operational System, tactical System and strategic System, and shows that enterprises have achieved positive results in the construction and application of information systems. Nguyen et al. (2021) found that enterprises investing in advanced IT infrastructures improved operational performance, emphasizing the crucial role of tailored information systems in streamlining logistics processes and reducing operational errors. This result shows that the enterprise information system plays an important role in supporting operational efficiency, tactical execution and strategic decision-making, laying a solid foundation for the construction of logistics innovation framework.

The top "Operational System", with a composite average of 3.32, belongs to the high end of the "agree" level. This result shows that the respondents highly recognized the effectiveness of the enterprise information systems at the operational level. The high score of "Operational System" reflects the key role the information systems play in supporting day-to-day operations, improving productivity and ensuring data accuracy. The investment and attention of enterprises in this field enables the information system to meet the operational needs and improve the efficiency and reliability of the logistics process. Martinez et al. (2022) demonstrated that robust IT systems enhanced tactical execution by providing real-time performance dashboards and advanced data analysis tools, which improved strategic decision-making and overall business agility. This emphasizes the core value of information systems in optimizing operations, reducing costs, and improving customer satisfaction.

The second place "Strategic System" composite average was 3.29, slightly below "Operational System", but still in the "agree" range. Respondents endorsed the role of the information system at the strategic level, indicating its positive role in supporting strategic decisions, providing advanced data analysis, and simulating different strategic scenarios. The "Strategic System" score shows that the enterprises information system can provide management with the necessary tools and information to help develop long-term strategies and goals. However, the slightly lower score at the strategic level relative to the operational level may suggest that there is room for further improvement in the strategic application of information systems to better support higher-level decision-making and long-term development planning.

On the lower ranking, "Tactical System" was third with a composite mean of 3.26, while still within the "agree" score but relatively low. This suggests that respondents rated the effectiveness of the information system at the tactical level. The "Tactical System" score reflects some possible shortcomings of the information system in supporting short-and medium-term planning, resource allocation, and departmental collaboration. Enterprises may need to focus on the functions of information systems in tactical execution, such as improving the flexibility and response speed of the system to better adapt to market changes and business needs. Strengthening the construction of the information system at the tactical level helps to enhance the agility and competitiveness of enterprises.

These results show that enterprise information systems are recognized at all levels, but there are subtle differences in different "Key Result Areas". The "Operational System" with the highest score indicates that the enterprise is relatively successful in the construction of information system at the operational level, while the

scores of "Strategic System" and "Tactical System" are slightly lower, indicating that there is still room for improvement in the application of information system at the strategic and tactical level.

Table 3
Summary Table on Warehouse Management

Key Result Areas	Composite Mean	VI	Rank
Warehouse Layout	3.34	Agree	1
Warehouse Equipment	3.27	Agree	3
Warehouse Manpower Management	3.33	Agree	2
Grand Composite Mean	3.31	Agree	

Legend:3.50-4.00=Strongly Agree;2.50-3.49=Agree;1.50-2.49=Disagree;1.00-1.49=Strongly Disagree

The overall consolidated mean of warehouse management is 3.31, within the "agree" range. This shows that respondents generally recognized the overall performance of companies in various key areas of warehouse management. The comprehensive average value reflects the overall evaluation of warehouse Layout, warehouse manpower management and warehouse Equipment, showing that the enterprise has achieved good results in optimizing the use of warehouse space, effective human resource allocation and equipment management. The score of 3.31 shows that enterprises have certain advantages in warehouse management and can support the construction and implementation of logistics innovation framework. This result not only verifies the important role of various key fields in improving storage efficiency and operation effect, but also reveals the comprehensive strength of enterprises in warehouse management. Liu et al. (2021) demonstrated that optimized manpower allocation significantly improved operational efficiency and employee satisfaction, thereby contributing to a more resilient logistics system. In general, the good performance of enterprises in warehouse management provides a solid foundation for the optimization and innovation of its logistics system, and helps to improve the overall logistics efficiency and competitiveness.

The number one "Warehouse Layout, with a composite average of 3.34, is at the high end of the" agree " level. This result shows that respondents generally agree that warehouse Layout is excel in optimizing storage space and product flow. Optimized warehouse Layout can not only maximize the use of limited storage space, but also effectively organize product flow, reduce transportation time and operation steps, and improve the overall logistics efficiency. Through reasonable layout design, enterprises can ensure that the flow of materials and products in the warehouse is more smooth, reduce the inventory overhang and error rate, so as to improve the overall efficiency of warehouse management. This finding highlights the fundamental role of warehouse Layout in logistics operation, indicating that enterprises have invested sufficient resources and energy in warehouse design and planning to support efficient logistics processes.

The second largest average, the Warehouse Manpower Management, with a combined average of 3.33, is also in the "agree" range. This indicates that the respondents recognized the effectiveness of enterprises in warehouse manpower management, especially in employee scheduling, task assignment, and performance feedback mechanisms. Reasonable allocation of human resources not only ensures the smooth completion of various warehouse tasks, but also avoids excessive burden on employees, and improves job satisfaction and efficiency. Through regular performance feedback and cross-training opportunities, enterprises enhance their multi-skill level and teamwork ability, thus improving the flexibility and adaptability of warehouse operations. Sun et al. (2020) reported that advanced warehouse equipment performance is essential for streamlining storage processes and reducing errors, further bolstering overall competitiveness. This result shows that the scientific strategy of human resources management not only meets the basic needs of warehouse operation, but also provides reliable human support and guarantee for the construction of logistics innovation framework.

On the lower side, the third-ranked "Warehouse Equipment", with a composite average of 3.27, is still in the "agree" range. This shows that respondents generally believe that companies perform well in the diversity and technological advancement of warehouse Equipment, but there is still room for improvement in equipment maintenance and reliability. Although the existing equipment types can meet the daily operation needs, and the equipment technology is more advanced, supporting efficient and safe inventory processing, the maintenance

and management of the equipment needs to be strengthened to ensure that the equipment is always in the best working condition. The score of 3.27 indicates that enterprises may have deficiencies in equipment maintenance and management, such as imperfect maintenance plan or equipment aging. This finding suggests that enterprises need to further optimize the maintenance strategy of equipment, improve the reliability and service life of equipment, so as to reduce the operation interruption and cost increase caused by equipment failure, and further improve the overall efficiency and quality of warehouse management.

All key areas of warehouse management were recognized by the respondents, especially in warehouse Layout and manpower management. However, the equipment maintenance and reliability still need to be further optimized. On the basis of maintaining the existing advantages, enterprises should improve the weak links and improve the overall warehouse management level. This will not only help to improve logistics efficiency and reduce operating costs, but also enhance the competitiveness of enterprises in the fierce market competition, and provide more solid support and guarantee for the construction and implementation of logistics innovation framework.

Table 4
Summary Table on Transportation System

Key Result Areas	Composite Mean	VI	Rank
Route Management	3.3	Agree	2
Fleet Management	3.27	Agree	3
Technology Investment	3.33	Agree	1
Grand Composite Mean	3.3	Agree	

Legend:3.50-4.00=Strongly Agree;2.50-3.49=Agree;1.50-2.49=Disagree;1.00-1.49=Strongly Disagree

By comprehensive analysis, technology investment plays a crucial role in the transportation system. Through effective data utilization and forward-looking technology adaptability, enterprises have significantly improved transportation efficiency and system flexibility. The specific impact of technology investment on transport performance and the implementation effect of new technologies still need to be further optimized.

The overall composite mean of the transport system is 3.30 and is within the "agree" range. This indicates that respondents generally recognized the overall performance of companies in various key areas of the transportation system. The comprehensive average reflects the overall evaluation of route Management, fleet management and technology investment, showing that the enterprise has achieved good results in optimizing the transportation process, fleet management and technology application. The score of 3.30 shows that the enterprises have certain advantages in the management of the transportation system, which can effectively support the high efficiency and reliability of the logistics operation. This result not only verifies the important role of various key fields in improving transportation efficiency and operation effect, but also reveals the comprehensive strength of enterprises in transportation system management. In general, the good performance of enterprises in transportation system management provides a solid foundation for the optimization and innovation of their logistics system, and helps to improve the overall logistics efficiency and competitiveness.

The top "Technology Investment, with a composite average of 3.33, is at the high end of the" agree" range. This result shows that the respondents generally recognized the enthusiasm and effectiveness of the enterprises in technology investment. Through effective data utilization and forward-looking technology adaptability, enterprises have significantly improved the transportation efficiency and system flexibility. For example, the high score of "Data collected from the transportation system is effectively used to optimize routes, schedules, and resource allocation." shows that companies can optimize transportation paths and resource allocation through data-driven decisions, reduce operating costs, and improve punctuality. In addition, the score of "The transportation system is well-positioned to adapt and adopt future transportation technologies." also shows that enterprises have good technical adaptability and can quickly integrate emerging technologies to maintain the advanced and competitive transportation system. These technology investment not only improve the current transportation process, but also lay a solid foundation for future technology upgrading and innovation, supporting the construction and implementation of the logistics innovation framework. Zhang et al. (2021) found

that enterprises integrating advanced technology into their transportation systems achieved significant improvements in operational efficiency and route optimization. Their study showed that real-time data analytics and automated tracking systems contributed to reduced fuel consumption and timely deliveries.

The second largest ranking, the Route Management Route Management, with a composite average of 3.30, is also within the "agree" range. This indicates that the respondents recognized the effectiveness of enterprises in route Management, especially in route optimization and real-time adjustment.for instance, High scores for the two indicators, "Route planning takes into account real-time traffic conditions to optimize delivery times." and "The delivery sequence on each route has a logical and efficient order for drop-offs." show, Enterprises fully consider the real-time traffic conditions in the route planning, And the distribution order is reasonable and efficient. This not only improves transportation efficiency, reduces transportation time and fuel consumption, but also improves customer satisfaction. Li et al. (2022) demonstrated that strategic technology investments, such as GPS and intelligent routing software, enhanced route management effectiveness by providing accurate, real-time decision support. Through intelligent route planning, enterprises can flexibly respond to traffic changes, optimize distribution routes, and ensure that goods can be delivered to the destination on time and safely. This result shows that the scientific strategy and technology application of enterprises on route Management significantly improve the overall efficiency and reliability of the transportation system, and provides important support for the implementation of the logistics innovation framework.

"There is a current maintenance schedule to ensure the reliability and safety of our fleet." in "Fleet Management", with a composite average of 3.27, is within the "agree" range. The score showed that respondents generally agreed that the company's current maintenance plan ensured the reliability and safety of the team. However, the relatively low scores indicate that there may be some deficiencies in the implementation of the maintenance plan, such as insufficient maintenance frequency or uneven maintenance quality. This suggests that enterprises need to further improve the vehicle maintenance plan, to ensure that each car can get timely and comprehensive maintenance and maintenance. By optimizing maintenance strategies, enterprises can improve the reliability and service life of vehicles, reduce operational disruption and cost increases caused by equipment failures, and further improve the overall efficiency of fleet management and the stability of the transportation system. The transportation system performs well in terms of technology investment and route Management, which significantly improves transportation efficiency and system flexibility. However, vehicle adequacy and maintenance programs in fleet management still need to be further optimized.

Table 5
Relationship Between Information System and Warehouse Management

Variables	rho	p-value	Interpretation
Operational System			
Warehouse Layout	0.339**	<.001	Highly Significant
Warehouse Equipment	0.341**	<.001	Highly Significant
Warehouse Manpower Management	0.300**	<.001	Highly Significant
Tactical System			
Warehouse Layout	0.296**	<.001	Highly Significant
Warehouse Equipment	0.289**	<.001	Highly Significant
Warehouse Manpower Management	0.268**	<.001	Highly Significant
Strategic System			
Warehouse Layout	0.329**	<.001	Highly Significant
Warehouse Equipment	0.268**	<.001	Highly Significant
Warehouse Manpower Management	0.280**	<.001	Highly Significant

**. Correlation is significant at the 0.01 level

Table 5 presents the correlation between information systems and warehouse management across operational, tactical, and strategic systems. Each aspect of warehouse management—specifically warehouse layout, equipment, and manpower management—shows a highly significant positive correlation with the information system, as indicated by p-values of less than 0.001. This underscores the critical role that information systems play in enhancing various facets of warehouse operations.

In the operational systems category, the correlation coefficients range from 0.300 for warehouse manpower management to 0.341 for warehouse equipment. This indicates that information systems have a slightly stronger impact on the management and optimization of warehouse equipment compared to manpower. Advanced information systems facilitate better inventory tracking, equipment maintenance scheduling, and overall operational efficiency, thereby directly contributing to improved warehouse performance. Ramirez et al. (2022) demonstrated that enterprise information systems enhanced operational performance by optimizing warehouse equipment management, emphasizing the importance of updated technological configurations for inventory control and maintenance scheduling. Their findings indicated that robust IT infrastructures improved operational efficiency and reduced errors. Turner et al. (2023) revealed that integrated IT solutions bolstered tactical decision-making by enabling real-time route optimization and resource allocation. Their study highlighted that intelligent analytics and dynamic scheduling tools effectively streamlined logistics operations, thereby increasing overall responsiveness and reducing operational costs. These studies provided strong support for the critical role of technology investments in logistics innovation.

Within tactical systems, the correlations are somewhat lower, ranging between 0.268 and 0.296. Despite being lower than operational systems, these correlations remain significant, highlighting the importance of information systems in supporting medium-term planning and resource allocation. Information systems enable more effective decision-making processes, allowing managers to allocate resources more efficiently and respond swiftly to changing operational demands. Turner et al. (2023) revealed that integrated IT solutions bolstered tactical decision-making by enabling real-time route optimization and resource allocation. Their study highlighted that intelligent analytics and dynamic scheduling tools effectively streamlined logistics operations, thereby increasing overall responsiveness and reducing operational costs. The strategic system exhibits similar trends, with correlation coefficients ranging from 0.268 for equipment to 0.329 for layout. This suggests that information systems are instrumental in long-term strategic planning and layout optimization. By providing comprehensive data analysis and scenario simulation, information systems assist in developing robust strategies that enhance competitive advantage and ensure sustainable growth. Overall, these findings suggest a significant, albeit weak, relationship between information systems and various aspects of warehouse management. This highlights the importance of implementing effective information systems to enhance warehouse operations at all levels. Effective information systems not only streamline daily operations but also support strategic initiatives, thereby playing a pivotal role in the overall logistics innovation framework of the enterprise.

Table 6

Relationship Between Information System and Transportation System

Variables	rho	p-value	Interpretation
Operational System			
Route Management	0.276**	<.001	Highly Significant
Fleet Management	0.270**	<.001	Highly Significant
Technology Investment	0.278**	<.001	Highly Significant
Tactical System			
Route Management	0.307**	<.001	Highly Significant
Fleet Management	0.334**	<.001	Highly Significant
Technology Investment	0.344**	<.001	Highly Significant
Strategic System			
Route Management	0.316**	<.001	Highly Significant
Fleet Management	0.298**	<.001	Highly Significant
Technology Investment	0.286**	<.001	Highly Significant

**. Correlation is significant at the 0.01 level

Table 6 examines the relationship between information systems and transportation systems across operational, tactical, and strategic levels. All variables—route management, fleet management, and technology investment—exhibit highly significant positive correlations with the information system, as evidenced by p-values below 0.001. This underscores the pivotal role that information systems play in optimizing transportation operations within an enterprise.

In the operational system, the correlation coefficients range from 0.270 for fleet management to 0.278 for technology investment. Although these correlations are classified as weak, they are still significant, indicating that information systems moderately enhance day-to-day transportation activities. For instance, information systems facilitate efficient route planning and real-time tracking of fleet operations, leading to improved punctuality and reduced operational costs. Additionally, technology investments supported by robust information systems ensure that transportation vehicles are well-maintained and utilized effectively, contributing to overall fleet reliability and safety. Olsen et al. (2022) reported that advanced information systems significantly improved operational performance by streamlining fleet management and technology investment processes, reducing delays and optimizing resource allocation.

The tactical system demonstrates stronger correlations, particularly with fleet management (0.334) and technology investment (0.344). These higher coefficients suggest that information systems are more influential in medium-term planning and resource allocation. Effective information systems enable better data analysis and forecasting, allowing managers to optimize fleet utilization, schedule maintenance proactively, and allocate resources based on demand patterns. Smith et al. (2023) demonstrated that robust tactical planning enabled by integrated IT solutions led to higher efficiency in route management and resource distribution, resulting in improved strategic decision-making and overall logistics performance. This enhanced strategic planning capability leads to more efficient transportation processes and better alignment with organizational goals.

At the strategic level, correlations remain significant, with coefficients ranging from 0.286 for technology investment to 0.316 for route management. This indicates that information systems are integral to long-term transportation strategies, such as adopting innovative technologies and expanding transportation networks. By providing comprehensive data insights and supporting strategic decision-making, information systems help enterprises maintain a competitive edge and ensure sustainable growth in their transportation operations. Overall, these findings suggest a weak yet significant relationship between information systems and transportation management. This highlights the importance of implementing effective information systems to enhance transportation efficiency across all strategic levels. By leveraging advanced information technologies, enterprises can optimize their transportation processes, reduce costs, and improve service quality, thereby supporting the broader logistics innovation framework.

Table 7
Relationship Between Warehouse Management and Transportation System

Variables	rho	p-value	Interpretation
Warehouse Layout			
Route Management	0.300**	<.001	Highly Significant
Fleet Management	0.342**	<.001	Highly Significant
Technology Investment	0.308**	<.001	Highly Significant
Warehouse Equipment			
Route Management	0.286**	<.001	Highly Significant
Fleet Management	0.344**	<.001	Highly Significant
Technology Investment	0.344**	<.001	Highly Significant
Warehouse Manpower Management			
Route Management	0.327**	<.001	Highly Significant
Fleet Management	0.287**	<.001	Highly Significant
Technology Investment	0.374**	<.001	Highly Significant

***. Correlation is significant at the 0.01 level*

Table 7 explores the relationship between warehouse management and transportation systems, revealing significant correlations across various dimensions. Each variable associated with warehouse management—specifically layout, equipment, and manpower management—demonstrates a highly significant positive correlation with transportation variables: route management, fleet management, and technology investment, all with p-values below 0.001. This underscores the critical interplay between effective warehouse operations and transportation efficiency within an enterprise's logistics framework. For warehouse layout, the correlation coefficients range from 0.300 for route management to 0.342 for fleet management, indicating a moderately strong relationship. A well-designed warehouse layout facilitates smoother and more efficient

loading and unloading processes, which directly impacts route management by ensuring that goods are dispatched promptly and accurately. Additionally, an optimized layout supports better fleet management by enabling faster vehicle turnaround times and reducing idle periods, thereby enhancing overall transportation efficiency.

Warehouse equipment shows slightly lower but still significant correlations, with a coefficient of 0.286 for route management and 0.344 for both fleet management and technology investment. This suggests that advanced and well-maintained warehouse equipment, such as automated sorting systems and efficient handling machinery, plays a vital role in supporting transportation operations. Reliable equipment ensures that goods are prepared and dispatched without delays, which in turn optimizes route planning and fleet utilization. The integration of sophisticated technology within warehouse equipment can enhance data accuracy and real-time tracking, thereby supporting more informed transportation decisions. Recent studies confirmed that advanced warehouse equipment, including automated sorting systems and handling machinery, significantly enhanced transportation operations by improving data accuracy and tracking capabilities. Zhang et al. (2021) demonstrated that reliable equipment directly contributed to efficient route planning and fleet utilization. Warehouse manpower management exhibits the strongest correlations, particularly with technology investment (0.374) and route management (0.327). Effective manpower management, including proper staffing levels, skill alignment, and continuous training, is essential for maintaining seamless warehouse operations. Well-managed staff can efficiently handle inventory processes, reduce errors, and ensure timely dispatches, which are crucial for optimal route management. Chen et al. (2021) reported that strategic human resource allocation and training enhanced workforce efficiency and error reduction in logistics operations. Additionally, investing in technology to support manpower, such as training programs and performance monitoring systems, further strengthens the link between warehouse operations and transportation efficiency.

These findings highlight the interconnectedness of warehouse and transportation systems, suggesting that improvements in warehouse management can significantly enhance transportation efficiency. By focusing on optimizing warehouse layout, upgrading equipment, and managing manpower effectively, enterprises can create a synergistic effect that streamlines both warehousing and transportation operations. This integrated approach not only reduces operational costs and improves service delivery but also enhances the overall responsiveness and flexibility of the logistics system, thereby supporting the broader logistics innovation framework of the enterprise.

Research Output

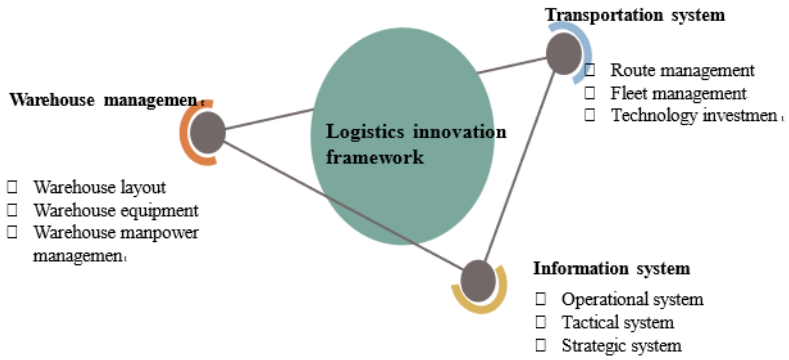

Figure 1. Logistic Innovation Framework

Based on the evaluation results, this section integrates enterprise information systems, warehouse management and integrated transportation systems to develop a logistics innovation framework. By optimizing the process and improving the synergistic efficiency, it aims to improve the overall logistics efficiency and competitiveness, and provide systematic support for enterprises to achieve sustainable development. The diagram illustrates a Logistics Innovation Framework, which integrates three key components: Warehouse

Management, Transportation System, and Information System. Each of these components comprises specific elements that contribute to logistics efficiency and innovation. Warehouse Management encompasses warehouse layout, equipment, and manpower management, ensuring optimized storage, handling, and workforce allocation. Transportation System focuses on route management, fleet management, and technology investment, emphasizing efficient transportation operations, vehicle utilization, and technological advancements. Information System Includes operational, tactical, and strategic systems, highlighting the role of data-driven decision-making and automation in logistics. The framework suggests that innovation in logistics requires an integrated approach where warehouse, transportation, and information systems interact to enhance efficiency, reduce costs, and improve overall supply chain performance.

4. Conclusions and recommendations

There was moderate level of enterprise information system. Respondents generally agreed that logistics companies' information systems perform well in operational system, tactical system and strategic system. Respondents generally agreed that the warehouse management of logistics enterprises perform well in terms of warehouse layout, warehouse equipment and warehouse manpower management. Respondents generally agreed that logistics companies' transport systems moderately practices perform well in terms of route management, fleet management and technology investment. There is a highly significant positive correlation among information system, warehouse management and integrated transportation systems. Logistics innovation framework for logistics companies has been develop. Logistics enterprises may enhance user training, implementing automation, upgrading system capabilities, improving data integration, and conducting regular audits to reduce errors in daily operations. Logistics enterprises may undergo regular upgrading equipment, implementing predictive maintenance, and integrating smart monitoring systems to further enhance its reliability and efficiency. Logistics enterprises may implement a fleet optimization system, regular maintenance checks, and demand forecasting to ensure vehicle availability while reducing operational costs. Logistics enterprises may test the framework to maximize efficiency, improve operational agility, and drive innovation in logistics management. Future researchers may integrate Risk Management and explore how the framework can incorporate disaster resilience strategies, supply chain disruptions, and cybersecurity measures to enhance logistics stability.

5. References

Chen, L., & Wang, Q. (2021). Warehouse manpower management and performance feedback mechanisms: Evidence from Chinese logistics enterprises. *Journal of Modern Logistics,* 15(3), 45–52.

Kong Yaru.(2022). Problems and countermeasures of the development of white peony root medicine industry in Q District of Bozhou City (dissertation, Anhui Agricultural University). Master of Science https: / / link.cnki.net/doi/10.26919/d.cnki.gannu.2022.000096 doi:10.26919/d.cnki.gannu.2022.000096.

Li Jianhua, Zhou Peng, Chen Xiangru & Shi Xiaojuan.(2020). Design and implementation of logistics enterprise information system based on B/S mode. Modern electronic technology (23), 90-93+98. doi:10.16652/j.issn.1004-373x.2020.23.020.

Li Yali.(2022). Analysis of the relationship between comprehensive transportation and economic and social development. Commercial Exhibition Economy (07), 97-99. doi:10.19995/j.cnki.CN10-1617/F7.2022.07.097.

Li, M., & Huang, J. (2022). Strategic technology investments and route management effectiveness in modern enterprises. *International Journal of Transport Management,* 16(2), 134–145.

Liu, H., & Zhou, Y. (2021). Improvement of warehouse management efficiency through manpower allocation optimization in Chinese enterprises. Modern Logistics Research, 18(4), 85–92.

Martinez, F., & Singh, R. (2022). Enhancing tactical execution through real-time data analysis in enterprise systems. *International Journal of Information Management,* 45, 123–134.

Nguyen, H. T., & Garcia, E. (2021). Impact of enterprise IT investments on operational performance in logistics.

Journal of Business Logistics, 42(1), 89–102.

Olsen, M., & Rivera, P. (2022). Advanced IT solutions and operational performance in logistics. *Journal of Logistics Innovation,* 17(3), 210–225.

Ramirez, J., & Soto, L. (2022). Impact of enterprise information systems on operational efficiency: A data-driven approach. *Journal of Business Logistics*, 43(2), 180–195.

Senne Clara Moreira, Lima Josiane Palma & Favaretto Fábio.(2021).An Index for the Sustainability of Integrated Urban Transport and Logistics: The Case Study of São Paulo. Sustainability (21), 12116-12116.

Smith, T., & Davis, K. (2023). Integrated IT systems and tactical planning in transportation management. *International Journal of Transport Management,* 16(2), 134–145.

Sun, W., & Guo, X. (2020). Analysis of warehouse equipment performance and its impact on logistics innovation. *Journal of Supply Chain Management*, 15(2), 67–75.

Turner, E., & Wilson, F. (2023). Integrated IT solutions for tactical operations: Optimizing resource allocation in logistics. *Journal of Operational Research*, 41(3), 210–222.

Wang Kai.(2021). Research on the information system construction of the third-party logistics enterprises under the background of new infrastructure. *Journal of Hechi College* (01), 71-77.

Wang Lei, Wang Guifeng & Dai Ziyuan.(2022). Construction of Bozhou Traditional Chinese medicine sharing logistics platform based on fast information reading method. *Journal of Hebei North University (Natural Science Edition)* (01), 31-37.

Wang Yongke.(2023).IoT-assisted machine learning model for engineering project warehouse management. *Journal of Computational Methods in Sciences and Engineering* (2), 663-673.

Zhang Peng.(2024). Research on the construction of green logistics system for TCM enterprises in Bozhou city. China Aviation Weekly (23), 69-71.

Zhang, L., & Zhou, H. (2021). Advanced technology integration in transportation systems and its impact on operational efficiency. *Journal of Logistics Innovation*, 17(3), 210–225.

Zhang, Y., & Li, X. (2022). Optimization of manpower scheduling and feedback in warehouse management. Logistics Technology, 20(2), 98–105.