

## Features of The Data-Driven Logistics 360° Methodology as A Comprehensive Approach to Optimizing Logistics Processes and Increasing A Company’s Operating Profit

**Maxim Andreevich Perminov**

Expert in International Logistics and Predictive Supply Chain Management Saint Petersburg, FL, USA

Article received: 29/08/2025, Article Revised: 06/09/2025, Article Accepted: 17/09/2025, Article Published – 31/10/2025

© 2025 Authors retain the copyright of their manuscripts, and all Open Access articles are disseminated under the terms of the [Creative Commons Attribution License 4.0 \(CC-BY\)](https://creativecommons.org/licenses/by/4.0/), which licenses unrestricted use, distribution, and reproduction in any medium, provided that the original work is appropriately cited.

---

### ABSTRACT

Under the intensifying pressure on the logistics sector’s margins, driven by outpacing cost dynamics, standard managerial practices are losing effectiveness. This study is aimed at the conceptualization and empirical validation of the comprehensive Data-Driven Logistics 360° methodology designed for the systemic optimization of logistics operations and the direct increase of operating profit. The research objective is to demonstrate a causal link between the implementation of data-based tools and the achievement of measurable financial outcomes. The methodological foundation rests on a mixed approach combining a systematic review of academic sources and a single-case study of George Biosystems for 2020–2023. Based on the analysis, an iterative three-tier model was developed: Diagnostics and analytical assessment, Identification and prioritization of problem areas, Implementation of solutions and verification of results. Practical testing of the model recorded a sustained reduction in key cost items, primarily for fuel and raw material procurement, within the range of 10–40%, which translated into a 7–14% increase in monthly operating profit. The study concludes that the proposed methodology serves not only as a tool for improving efficiency but also as a foundation for building operational resilience in supply chains. The reported results are addressed to leaders of logistics and operations functions as well as researchers in the field of supply chain management.

**Keywords:** data-driven logistics, logistics optimization, supply chain management, operating profit, efficiency improvement, case study, supply chain resilience, Internet of Things, big data analytics, cost management.

### INTRODUCTION

Contemporary logistics is unfolding in the context of unprecedented challenges that shape a contradictory macro- and microeconomic environment. With the continued expansion of global freight flows and trade turnover, the global market for logistics services is expected to grow by 3.8% in 2024 [1]. In the United States, aggregate business logistics costs in 2024 reached \$2.6 trillion, or 8.7% of GDP [5]. These indicators point to a systemic deficit of operational efficiency: extensive capacity expansion does not translate into a

commensurate increase in profits; on the contrary, it intensifies pressure on margins [2, 3].

As a result, traditional managerial practices that rely on mechanically raising rates to offset costs are losing viability in a competitive environment. The managerial focus is inevitably shifting from external price factors to internal sources of efficiency. The response is a sustained trend toward digital transformation and a shift to a paradigm of data-driven managerial decision making [4, 7]. It implies the institutionalization of Internet of Things (IoT), artificial intelligence (AI), and big data analytics

technologies for real-time operational and strategic management [6, 9]. The economic rationality of this transition is confirmed by the dynamics of the corresponding market: the global volume of digital logistics, estimated at \$32.44 billion in 2024, is projected to reach \$120.33 billion by 2032 at a compound annual growth rate of 18.1% [12]. Forecasts also indicate that by the end of 2024 more than 50% of corporate IT spending will be directed to digital transformation projects [12], and half of logistics companies will invest in AI-based and advanced analytics applications [13].

Despite the widespread recognition of the potential of data-driven approaches, a substantial research gap persists in the academic discourse. Existing studies primarily address isolated components of the problem: sophisticated mathematical models are developed for route and inventory optimization [14, 15], conceptual analytical materials are proposed [16, 17], or targeted examinations of the implementation of individual technologies are conducted [8, 9]. However, the authors themselves often note a mismatch between the theoretically excessive complexity of the models and their actual implementability in business processes [10, 11, 20]. Particularly notable is the deficit of empirical studies that present a holistic, step-by-step, and reproducible methodology capable of systematically linking specific operational data-driven initiatives (for example, the installation of GPS trackers on transport) to the ultimate, quantitatively measurable financial outcome at the level of a company's operating profit.

**The aim** of the present study is to develop and pilot, on the basis of a case study, a comprehensive methodology Data-Driven Logistics 360°, demonstrating a direct relationship between the phased implementation of data-driven tools and the growth of a company's operating profit.

**The scientific novelty** lies in the theoretical formalization and empirical verification of a cyclical methodology integrating diagnostic, analytical, and execution stages to achieve a measurable financial effect in logistics.

**The author's hypothesis** is that the sequential application of the Data-Driven Logistics 360° methodology, organized around the Diagnose – Prioritize – Execute cycle, ensures the optimization of key logistics metrics (costs, idle time) and directly contributes to an increase in the company's operating profit in the range of 7–14%.

## Materials and methods

To achieve the stated research objective and test the proposed hypothesis, the study employs a mixed design strategy that links conceptual rigor with applied relevance. This design is best suited to address the identified gap between theoretical constructs and their empirical substantiation in real business operating conditions.

The methodological architecture comprises two complementary blocks. The theoretical component is based on a systematic literature review covering relevant publications on data-driven logistics, digital transformation of supply chains, optimization models, and factors hindering their implementation [9]. The review results established the conceptual boundaries of the study, refined the conceptual apparatus, and documented the dominant approaches to data-driven logistics management.

The empirical component is implemented as a case study, selected for an in-depth and holistic examination of a specific practical case with the aim of piloting and validating the authorial methodology Data-Driven Logistics 360°. The use of a case study makes it possible not to limit the analysis to a description of the phenomenon, but to reconstruct the causal relationships between managerial decisions and achieved outcomes within their natural institutional and operational environment.

The source base was structured by type and functional role in the study. The first set, a body of research, is represented by academic publications: peer-reviewed journal articles indexed in international systems such as Scopus and Web of Science, as well as proceedings of recognized global conferences (including IEEE and Springer). This corpus provided the theoretical and methodological framework of the work, ensuring strict scientific validity and alignment with the current state of knowledge in supply chain management.

The second set of materials includes analytical reports and industry statistics: publications by leading consulting firms (McKinsey & Company, Deloitte, Ernst & Young (EY), Gartner), as well as current statistical indicators of the logistics sector for 2024. These sources were used to substantiate the relevance of the topic, to contextualize the results, and to relate them to global market trends.

The empirical basis for testing the methodology consisted

of primary operational and financial data from George Biosystems for 2020–2023. The provided dataset covers descriptions of implemented logistics initiatives (including the deployment of fleet monitoring systems and the diversification of the supplier base) and their quantitatively measurable effects: the dynamics of raw material and fuel costs and, crucially, the direct impact on operating profit. The analysis conducted made it possible to verify the proposed methodology and confirm the advanced hypothesis.

## **Results and discussion**

In the study, the Data-Driven Logistics 360° methodology is interpreted as an integrated, iterative managerial loop. In contrast to a set of disparate tools and models, it sets a systemic perspective that encompasses the full cycle of managerial decision making: from data extraction and preparation to verification of the achieved financial outcome. The concept is structured as a continuous process of three interrelated stages, embodying the logic of continuous improvement characteristic of classical managerial cycles (e.g., Deming's PDCA), but reinterpreted in light of the realities of modern logistics.

The initial stage is diagnosis and analysis. This starting stage serves as the methodological foundation of the entire framework. Its key objective is to form an exhaustive and unbiased understanding of the current configuration of the logistics system. This is achieved through a comprehensive audit and targeted data collection across key areas: the technical condition and operating regime of the vehicle fleet, the structure and reliability of the supplier base, the effectiveness of warehouse operations, compliance with storage conditions, etc. At this stage, heterogeneous streams (ERP systems, GPS trackers, sensors, financial statements) are integrated in order to construct a digital imprint — up to a digital twin — of logistics processes [11]. This mode of observation makes it possible to detect

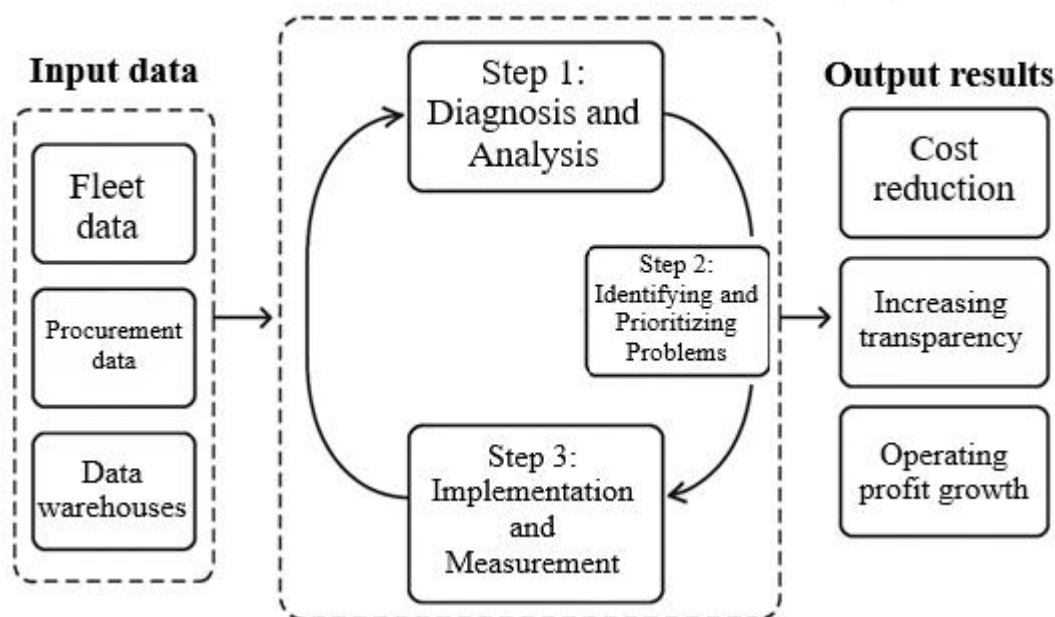
hidden anomalies, bottlenecks, and deviations from target metrics that elude traditional fragmentary analysis.

Next follows the second stage, which involves the identification and prioritization of problems. The materials collected at the first stage are subjected to in-depth analytical processing to detect bottlenecks — critical constraints that set the ceiling for the system's performance and profitability [29]. A simple inventory of defects does not work here: the key is a scientifically grounded ranking of the identified causes. To this end, proven approaches are applied — from the Pareto principle (focusing on those 20% of problems that generate 80% of the aggregate loss) to prioritization matrices (for example, the Eisenhower matrix), where each problem is evaluated along two orthogonal axes: impact on costs/risks and difficulty/cost of elimination. This configuration of criteria enables the targeted allocation of limited resources and directs efforts to where the greatest and fastest effect is expected.

The last, third stage is the implementation of solutions and the measurement of results. Based on the priorities established at the second stage, targeted technological and organizational interventions are designed and deployed: from installing monitoring systems and introducing new software to revising supplier contracts and reorganizing warehouse processes. A critically important component is the continuous tracking of key performance indicators (KPI) in real time. This is necessary not only to verify the effectiveness of the changes but also, crucially, to restore a strict quantitative link between operational improvements (for example, a reduction in mileage) and financial outcomes (reduced fuel expenses and increased operating profit). Upon completion of the stage, the cycle closes and returns to diagnostics, ensuring a loop of continuous system improvement.

A visualization of the conceptual model is presented in Figure 1.

**Data-Driven Logistics 360° cycle**



**Fig. 1.** Schematic diagram of the conceptual model “Data-Driven Logistics 360°” (compiled by the author based on [11, 27, 29]).

The breakdown of tasks and tools by stages of the Data-Driven Logistics 360° model is presented for greater clarity in Table 1.

**Table 1.** Key stages, tasks, and tools within the Data-Driven Logistics 360° methodology (compiled by the author based on [18-20]).

Stage	Key tasks	Data and tools used	Expected outcome of the stage
1. Diagnostics and analysis	Audit of current processes, data collection and aggregation, creation of a digital imprint of operations.	GPS/GLONASS data, fuel sensor data, ERP data (procurement, warehouse), financial statements, ABC/XYZ analysis.	Objective, data-driven view of logistics processes. Detection of anomalies and areas of inefficiency.
2. Problem identification and prioritization	Identification of bottlenecks, assessment of problem impact on business metrics, task ranking.	Statistical analysis, correlation analysis, root cause analysis, prioritization matrix.	A compiled and ranked list of key problems with an assessment of their potential impact on costs and risks.
3. Solution implementation and measurement	Deployment of technological and organizational changes, KPI monitoring, assessment of the financial effect.	Monitoring systems (IoT), supplier relationship management platforms (SRM), BI systems and KPI dashboards, financial analysis (P&L).	Elimination of identified problems, achievement of measurable improvements in operational and financial indicators.

Practical validation of the Data-Driven Logistics 360° methodology was carried out using data from George Biosystems for 2020–2023. The organization faced a set of industry-typical challenges: cost escalation, a deficit of process transparency, and heightened vulnerability of supply chains. Implementation proceeded in stages, strictly following the logic outlined earlier.

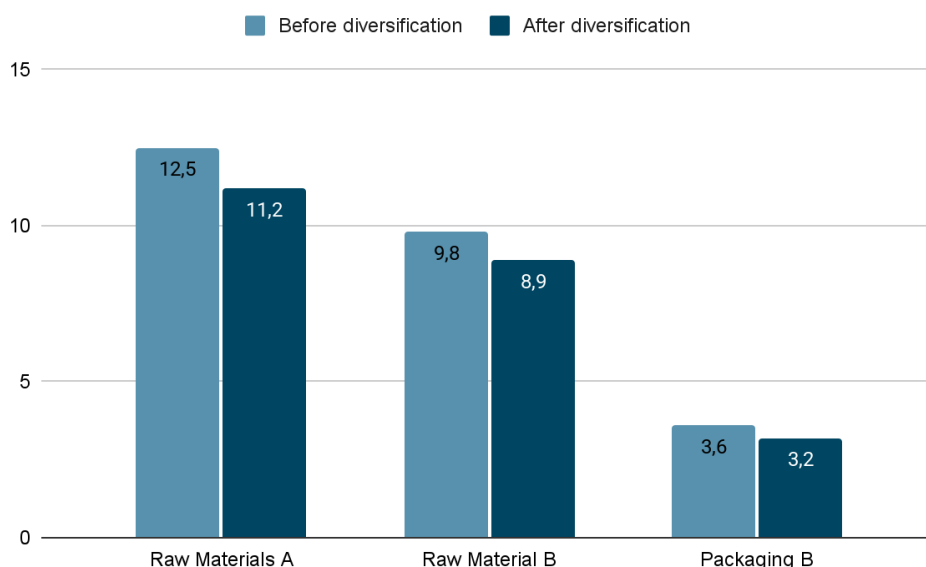
In the initial phase, a comprehensive audit of logistics operations was conducted based on corporate data sets, which made it possible to identify two critical areas of inefficiency. The first concerned fleet management: operational opacity led to misuse of company vehicles, excessive mileage, increased breakdowns due to untimely maintenance, and, consequently, systematic fuel losses. The second area was identified in procurement activities: high concentration on a narrow pool of counterparties created risks of supply disruptions and sustained elevated price levels for raw materials and inputs due to the absence of competitive pressure.

Next came the second stage, prioritization. Based on the diagnostic results, two key tasks were formulated and ranked. The primary focus was strict fleet control as a quick win with a clearly measurable economic effect at moderate capital expenditures. The second, strategic priority was supplier diversification aimed at reducing long-term risks and structurally lowering the cost of manufactured products.

Application of Stage 3 (Implementation): within the established priorities, two complementary blocks of

measures were introduced sequentially.

1. Fleet and logistics control: GPS trackers, fuel monitoring sensors, and thermologgers for refrigeration units were installed on all cargo units and regional managers' vehicles. This complex constitutes a typical IoT configuration that delivers a sharp increase in the observability and controllability of operational processes [7, 23, 24]. The telemetry infrastructure provides continuous monitoring of geotracks, fuel consumption, compliance with speed limits, and temperature regimes. The practical effect was the complete elimination of unauthorized trips and fuel theft, as well as a transition to proactive maintenance with optimized intervals, which led to fewer failures and downtimes.
2. Supply and procurement optimization: A targeted search with a concurrent audit of alternative counterparties was launched, resulting in the identification of over 20 new partners in both domestic and foreign markets. The company abandoned intermediary schemes in favor of direct contracts with manufacturers. This step, consistent with best practices in building resilient supply chains [25, 26], created a competitive environment among suppliers. As a result, purchase prices for key categories of raw materials, materials, and packaging declined substantially, in the range from 10% to 40%. A comparison of prices for priority items before and after diversification is presented in Fig. 2.



**Fig. 2.** Comparative analysis of the cost of raw materials before and after supplier diversification.

The key focus of the study is not the documentation of isolated operational improvements per se, but the demonstration of their direct translational effect on the company’s financial results. The implementation at George Biosystems of a package of initiatives under the Data-Driven Logistics 360° methodology produced a pronounced and verifiable increase in operating profit. The mechanism of impact is transparent: reductions in expenditures on fuel and on the procurement of raw materials and supplies lower the cost of goods sold (COGS); with revenue held constant, this mechanically widens the gross margin and, subsequently, the operating margin [21, 22].

Empirical evidence from the case shows that solely

through a 10–40% reduction in purchase prices the company achieved a 7–14% increase in monthly operating profit. The obtained magnitudes are not statistical outliers and are consistent with industry guiding estimates: according to Deloitte, organizations with advanced supply chain management practices exhibit on average 15% lower operating costs relative to comparable companies [28]. Hence, the results of George Biosystems serve as practical confirmation of the corresponding theoretical constructs and benchmarks.

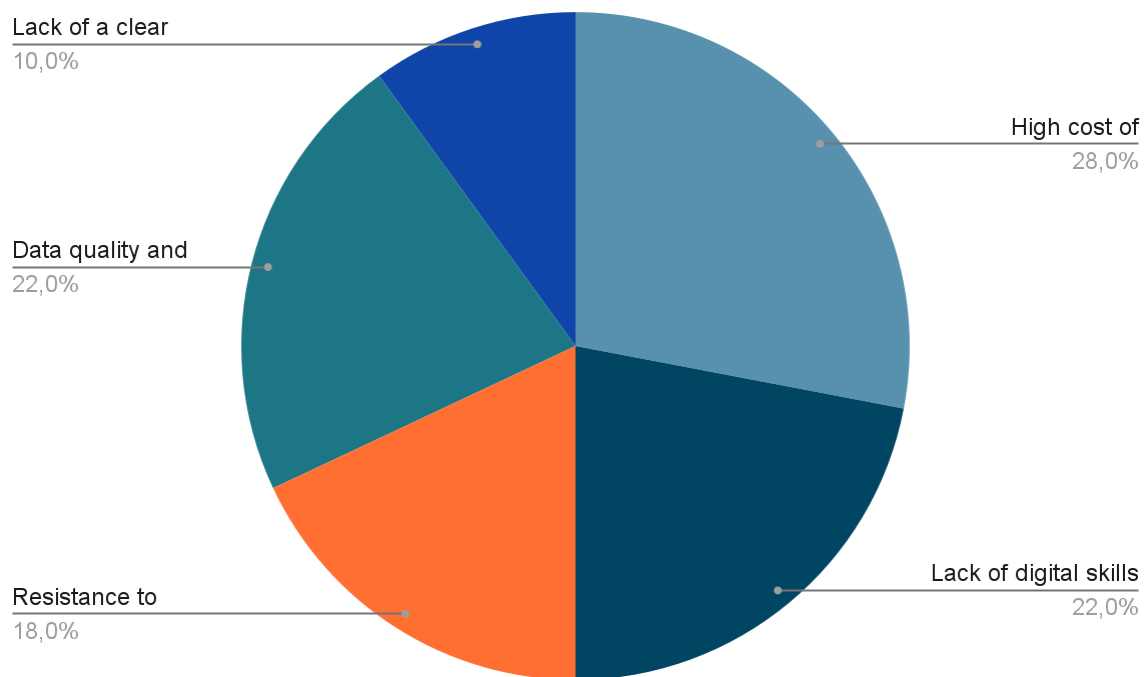
To visualize the causal chain between the implemented measures and the financial effect, Table 2 has been prepared, aggregating the impact of key decisions on performance metrics and operating profit.

*Table 2. Correlation of implemented logistics solutions with changes in KPIs at George Biosystems (compiled by the author based on [21, 22, 28]).*

<b>Implemented solution</b>	<b>Affected KPI</b>	<b>Indicator change</b>	<b>Direct impact on operating profit</b>
Implementation of GPS trackers and fuel sensors	Fuel and lubricant costs per unit of output/mileage	Significant decrease	Reduction of the variable component of cost, increase in product margin.
Implementation of GPS trackers and fuel sensors	Technical readiness coefficient of the vehicle fleet	Increase due to timely maintenance	Reduction of downtime losses, increased delivery stability, indirect impact on revenue.
Diversification of the supplier base	Weighted average cost of raw materials	Decrease by 10–40%	Direct reduction of the material component of cost of goods sold, substantial growth in gross and operating profit.
Diversification of the supplier base	Supply disruption risk (Supply Chain Risk)	Reduction due to the availability of alternative sources	Minimization of the risk of production stoppage and revenue loss, increased business resilience.

Despite the impressive results demonstrated in the George Biosystems case, it should be objectively recognized that the institutionalization of data-driven practices in logistics is associated with a broad spectrum of risks and constraints. The body of academic research and industry analytics indicates the presence of persistent systemic obstacles that can slow down or even entirely block digital transformation. Key factors include the capital intensity of technological deployment, a shortage

of specialists with relevant digital competencies, the inertia of organizational structures and resistance to change, as well as issues of data quality, consistency, and integration arising from fragmented IT landscapes. This picture is compounded by the absence of a coherent strategic foundation and institutionalized support from top management, without which the scaling of initiatives becomes challenging [31]. The relative significance of the above barriers is presented in Fig. 3.



**Fig. 3.** Main barriers to the implementation of data-driven approaches in logistics (compiled by the author based on [30-32]).

The proposed Data-Driven Logistics 360° methodology is natively equipped with tools to mitigate the aforementioned risks. Its phased and cyclical logic defines an iterative format of transformation. Already at the initial phase, Diagnostics, the organization, relying on empirical data, can localize segments in which technological investments will deliver the highest and most rapid return on investment (ROI). As demonstrated by the example of George Biosystems, the economic effect achieved by streamlining fleet management in the first cycle creates a resource base for subsequent, more capital-intensive initiatives in later iterations, up to and including the implementation of warehouse management systems (WMS) and supplier relationship management (SRM).

At the same time, the case analysis reveals a more substantial advantage of the methodology. It is crucial that the company succeeded in maintaining supply stability and operational continuity under martial law. This fact moves the approach beyond purely cost optimization and positions it as a framework for building operational resilience. Extreme external regimes—pandemics, geopolitical crises, natural disasters—concentrate the essence of a VUCA environment (Volatility, Uncertainty, Complexity, Ambiguity). Under such circumstances, the ability of the system to adapt quickly and maintain operability becomes a decisive source of competitive advantage.

The two basic action vectors at George Biosystems—supplier diversification and end-to-end, near-real-time control of the company’s own fleet—correspond to canonical and most effective strategies for enhancing supply chain resilience, widely reflected in the academic literature [30]. Diversification reduces dependence on single sources and geographies, whereas continuous monitoring of transport operations enables rapid rerouting and the mitigation of disruptions. Consequently, the company’s success during turbulence was determined not only by prior cost reduction, but also by the fact that the changes made the supply chain more flexible, transparent, and less susceptible to external shocks. In this light, the growth of operating profit appears not as an autonomous goal, but as a derivative of a more fundamental result: the construction of a resilient and adaptive logistics architecture. This expands the value horizon of the Data-Driven Logistics 360° methodology: it is relevant not only to optimization tasks, but also to full-fledged strategic risk management.

### **Conclusion**

The conducted study made it possible to theoretically delineate and empirically validate the methodology Data-Driven Logistics 360° as a coherent and effective approach to managing modern logistics systems. It has been demonstrated that the proposed iterative loop—diagnostics, prioritization, implementation—provides

systematic identification and elimination of operational losses based on objective metrics rather than intuitive judgments, thereby translating improvements from one-off initiatives into a governed, reproducible process.

The key outcome of the work is the verification of the initial hypothesis. A case-based trial using data from George Biosystems convincingly demonstrated a direct, quantitatively measurable relationship between the launch of data-driven initiatives and the dynamics of financial performance. The sequential deployment of telematics and fleet monitoring tools, supplemented by strategic diversification of the supplier base, led not only to improvements in operational KPIs but also to an increase in monthly operating profit by 7–14% due to reductions in major cost items by 10–40%.

The practical value of the study lies in offering logistics and operations executives a ready-to-use, stepwise, and reproducible algorithm for increasing efficiency and margins. Data-Driven Logistics 360° can serve as a roadmap for digital transformation and as a tool for the economic justification of investments in IT solutions through direct linkage to financial metrics. It is additionally shown that the approach goes beyond tactical optimization and forms a strategic framework for the operational resilience of supply chains—a quality that is critically important amid escalating global turbulence.

Prospects for subsequent research include expanding the empirical base by testing the methodology on a more diverse sample of industries to verify its universality. Scientific interest also lies in the development of predictive mathematical models capable of automating the prioritization stage by accurately forecasting the economic outcome of implementing particular logistics initiatives and thereby increasing the managerial precision of the entire cycle.

## References

1. Transportation and Logistics Industry Trends July 2024 - Atradius USA [Electronic resource]. Access mode: <https://atradius.us/knowledge-and-research/reports/industry-trends-transport-and-logistics-industry-trends-july-2024> (date of access: 07/25/2025).
2. DHL Road Freight Market News – Q 4 2024 [Electronic resource]. Access mode: <https://dhl-freight-connections.com/en/business/dhl-road-freight-market-news-q-4-2024/> (date of access: 07/27/2025).
3. Trucking Industry Segments Post Mixed Results in 2024 [Electronic resource]. Access mode: <https://www.ttnews.com/articles/top-100-for-hire-sectors-2025> (date of access: 07/29/2025).
4. Road Freight Services Market Size - By Service, By Vehicle, By Destination, By End Use, Analysis, Share, Growth Forecast, 2025 - 2034 [Electronic resource]. Access mode: <https://www.gminsights.com/industry-analysis/road-freight-services-market> (date of access: 07/29/2025).
5. Transport & Logistics Barometer [Electronic resource]. Access mode: <https://www.pwc.de/de/transport-und-logistik/pwc-transport-and-logistics-barometer-h2-2024.pdf> (date of access: 07/29/2025).
6. 'State of Logistics' Report Highlights AI's Freight Impact [Electronic resource]. Access mode: <https://aashtojournal.transportation.org/state-of-logistics-report-highlights-ais-freight-impact/#:~:text=U.S.%20business%20logistics%20costs%20totaled,pandemic%20patterns%20in%20some%20areas.> (date of access:08/18/2025).
7. Moshood T. D. et al. Digital twins driven supply chain visibility within logistics: A new paradigm for future logistics //Applied System Innovation. – 2021. – Vol. 4 (2). <https://doi.org/10.3390/asi4020029>.
8. Logistics Trends 2023/2024: Which Direction for AI? [Electronic resource]. Access mode: <https://dhl-freight-connections.com/en/trends/logistics-trends-2023-2024/> (date of access: 08/29/2025).
9. Lagorio A. et al. A systematic literature review of innovative technologies adopted in logistics management //International Journal of Logistics Research and Applications. – 2022. – Vol. 25 (7). – pp. 1043-1066.
10. Arunachalam D., Kumar N., Kawalek J. P. Understanding big data analytics capabilities in supply chain management: Unravelling the issues, challenges and implications for practice //Transportation Research Part E: Logistics and Transportation Review. – 2018. – Vol. 114. – pp.

- 416-436. <https://doi.org/10.1016/j.tre.2017.04.001>.
11. Zaidi S. A. H., Khan S. A., Chaabane A. Unlocking the potential of digital twins in supply chains: A systematic review //Supply Chain Analytics. – 2024. – Vol. 7. <https://doi.org/10.1016/j.sca.2024.100075>.
  12. Digital Logistics Market Size, Share | Growth Report [2032] [Electronic resource]. Access mode: <https://www.fortunebusinessinsights.com/digital-logistics-market-109139> (date of access: 09/07/2025).
  13. Supply chain trends 2024: The digital shake-up - KPMG International [Electronic resource]. Access mode: <https://kpmg.com/xx/en/our-insights/ai-and-technology/supply-chain-trends-2024.html> (date of access: 08/19/2025).
  14. Guan Q. et al. Real-time multi-depot urban logistics optimization in megacities via transformer-based deep reinforcement learning //International Journal of Geographical Information Science. – 2025. – pp. 1-24.
  15. Davuluri M. Optimizing Supply Chain Efficiency Through Machine Learning-Driven Predictive Analytics //International Meridian Journal. – 2023. – Vol. 5 (5).
  16. Wang K., Fan K., Chen Y. Optimization of Logistics Distribution Centers Based on Economic Efficiency and Sustainability: Data Support from the Hohhot–Baotou–Ordos–Ulanqab Urban Agglomeration //Sustainability (2071-1050). – 2025. – Vol. 17 (7).
  17. Özarık S. S., da Costa P., Florio A. M. Machine learning for data-driven last-mile delivery optimization //Transportation Science. – 2024. – Vol. 58 (1). – pp. 27-44.
  18. Li X. Optimization of logistics flow management through big data analytics for sustainable development and environmental cycles //Soft Computing. – 2024. – Vol. 28 (3). – pp. 2701-2717.
  19. Mandičák T. et al. Supply chain management and big data concept effects on economic sustainability of building design and project planning //Applied Sciences. – 2021. – Vol. 11 (23). <https://doi.org/10.3390/app112311512>.
  20. Rodríguez-Espíndola O. et al. Humanitarian logistics optimization models: An investigation of decision-maker involvement and directions to promote implementation //Socio-Economic Planning Sciences. – 2023. – Vol. 89. <https://doi.org/10.1016/j.seps.2023.101669>.
  21. Carnero Quispe M. F. et al. Humanitarian logistics prioritization models: a systematic literature review //Logistics. – 2024. – Vol. 8 (2). <https://doi.org/10.3390/logistics8020060>.
  22. Alanazi A., Al-Gahtani K., Alsugair A. Framework for smart cost optimization of material logistics in construction road projects //Infrastructures. – 2022. – Vol. 7 (5). <https://doi.org/10.3390/infrastructures7050062>.
  23. Zdolsek Draksler T., Cimperman M., Obrecht M. Data-driven supply chain operations—the pilot case of postal logistics and the cross-border optimization potential //Sensors. – 2023. – Vol. 23 (3). <https://doi.org/10.3390/s23031624>.
  24. Tehnički glasnik - Technical journal - Sveučilište Sjever [Electronic resource]. Access mode: [https://www.unin.hr/wp-content/uploads/tj\\_17\\_2023\\_3.pdf](https://www.unin.hr/wp-content/uploads/tj_17_2023_3.pdf) (date of access: 08/26/2025).
  25. Frederico G. F. From supply chain 4.0 to supply chain 5.0: Findings from a systematic literature review and research directions //Logistics. – 2021. – Vol. 5 (3). <https://doi.org/10.3390/logistics5030049>.
  26. Tay H. L., Loh H. S. Digital transformations and supply chain management: a Lean Six Sigma perspective //Journal of Asia Business Studies. – 2022. – Vol. 16 (2). – pp. 340-353. <https://doi.org/10.1108/JABS-10-2020-0415>.
  27. Mastering Telecom Inventory Management: Strategies, Trends, and Optimization for B2B Success [Electronic resource]. Access mode: <https://geakminds.com/telecom-inventory-management-system/> (date of access: 08/26/2025).
  28. Profitability Paradox: Streamlined Supply Chains Boost Cost-Efficiency & Revenue Growth [Electronic resource]. Access mode: <https://www.nomadstrategies.ca/posts/the-profitability-paradox-how-streamlined-supply-chains-drive-both-cost-efficiency-and-revenue->

growth (date of access: 08/26/2025).

- 29.** Kumari S., Kumar R. Supply Chain Optimization Strategies for Enhanced Efficiency and Performance //IJFMR-International Journal For Multidisciplinary Research. – 2023. – Vol. 5 (4).  
<https://doi.org/10.36948/IJFMR.2023.V05I04.4428>.
- 30.** Denga E. M., Rakshit S. Risks in Supply Chain Logistics: Constraints and Opportunities in North-Eastern Nigeria //International Journal of Risk and Contingency Management (IJRCM). – 2022. – Vol. 11 (1). – pp. 1-18.
- 31.** Borovkov A. et al. Key barriers of digital transformation of the high-technology manufacturing: An evaluation method //Sustainability. – 2021. – Vol. 13 (20).  
<https://doi.org/10.3390/su132011153>.
- 32.** Wang M., Pan X. Drivers of artificial intelligence and their effects on supply chain resilience and performance: an empirical analysis on an emerging market //Sustainability. – 2022. – Vol. 14 (24).  
<https://doi.org/10.3390/su142416836>.