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IMPLEMENTATION OF WEB-BASED TRANSPORTATION MANAGEMENT SYSTEMS IN THE TRANSPORTATION INDUSTRY: A SYSTEMATIC LITERATURE REVIEW

IMPLEMENTASI WEB-BASED TRANSPORTATION MANAGEMENT SYSTEM DI INDUSTRI TRANSPORTASI : *SYSTEMATIC LITERATURE REVIEW*

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ABSTRACT

This systematic literature review examines 20 publications from 2020 to 2025 addressing the implementation of web-based Transportation Management Systems (TMS) across various transport sectors. Our analysis identifies three major clusters: first, enhanced operational visibility and fleet tracking via web/cloud solutions; second, process optimization through system integration, automation, and log-based analytics; third, significant implementation challenges stemming from organizational readiness, legacy system integration, and web security concerns. The three clusters interact with each other, so the success of web-based TMS depends not only on technology, but also on human involvement, processes, and infrastructure. From a theoretical perspective, our findings suggest extending technology adoption frameworks (e.g., TOE) to include variables such as data interoperability, digital readiness, and data governance. In practical terms, companies should conduct a comprehensive data readiness assessment, plan system integration (such as API or ERP), manage organizational change, and implement robust web security before launching a web-based transportation management system (TMS). Additionally, implementing real-time analytics and process mining on TMS logs is essential for continuous improvement. This review is limited by the heterogeneity of publication types (academic journals, industry reports, implementation projects), the lack of long-term quantitative performance data, and the absence of cross-country comparative studies. Future research should pursue multi-industry longitudinal studies, systematically evaluate web-based TMS performance metrics, and investigate security and interoperability issues as core components of the modern digital transportation ecosystem.

Keywords: *Online Transportation Management System; Web-Based TMS; System Integration; Real-Time Analytics; Digital Readiness; Cloud-Based Transportation; Data Security.*

ABSTRAK

Ulasan rinci ini menganalisis 20 artikel dari tahun 2020 hingga 2025 yang membahas cara industri transportasi berbeda menggunakan Sistem Manajemen Transportasi (TMS) online. Studi kami menyoroti tiga area utama: pertama, pelacakan kendaraan dan operasi yang lebih baik menggunakan teknologi online atau cloud; kedua, peningkatan proses melalui integrasi sistem yang lebih baik, otomatisasi, dan analisis log; ketiga, tantangan penting dalam implementasi sistem ini akibat kesiapan organisasi, masalah sistem lama, dan kekhawatiran tentang keamanan online. Area-area ini saling terkait, menunjukkan bahwa kesuksesan TMS online tidak hanya bergantung pada teknologi; tetapi juga melibatkan manusia, proses, dan sistem yang ada. Dari sudut pandang teoretis, hasil kami menyarankan bahwa model adopsi teknologi yang ada (seperti TOE) perlu diperluas untuk mencakup faktor-faktor seperti seberapa baik data bekerja sama, seberapa siap perusahaan untuk alat digital, dan bagaimana data dikelola. Secara praktis, bisnis perlu memeriksa kesiapan data mereka, merencanakan integrasi sistem, menangani perubahan di dalam perusahaan, dan memastikan keamanan online yang kuat sebelum mulai menggunakan TMS online. Selain itu, penggunaan analisis real-time dan pemeriksaan log TMS sangat penting untuk perbaikan berkelanjutan. Tinjauan ini memiliki beberapa keterbatasan karena mencakup berbagai jenis publikasi (seperti artikel akademik, laporan industri, dan implementasi proyek), tidak memiliki statistik kinerja jangka panjang, dan tidak membandingkan hasil dari negara yang berbeda.

Kata Kunci: TMS berbasis web; Sistem Manajemen Transportasi Online; Integrasi Sistem; Analitik Real-Time; Kesiapan Digital; Transportasi Berbasis Cloud; Keamanan Data.

INTRODUCTION

The transportation sector plays a strategic role in supporting economic activities, goods distribution, and human mobility. In the context of the modern supply chain, transportation is not only a means of movement but also a key element that determines operational efficiency, delivery timeliness, and the overall quality of logistics services. As distribution volumes increase, transportation networks become more complex, and demand for faster services rises, transportation organizations face significant challenges in managing fleets, routes, schedules, and information flow in an integrated manner.

The main issues commonly faced by the transportation industry include limited operational visibility, lack of data integration across systems, and dependence on manual processes or inflexible legacy systems. These conditions lead to delays in decision-making, cost inefficiencies, recording errors, and low responsiveness to changes in operational conditions in the field. These challenges are further exacerbated by digitalization demands, the need for real-time monitoring, and the rising risk of operational disruptions and data security threats.

To address these issues, many organizations have begun adopting Transportation Management Systems (TMS) as digital solutions for managing transportation activities. TMS functions to support planning, execution, monitoring, and evaluation of transportation processes systematically. Since 2020, the advancement of web and cloud technologies has driven a significant shift from desktop- or locally based TMS toward Web-Based Transportation Management Systems, which offer flexible access, system scalability, and cross-platform and cross-location integration.

The implementation of web-based TMS offers a variety of potential benefits, including real-time fleet monitoring, route and schedule optimization, integration with other systems such as Enterprise Resource Planning (ERP) and Warehouse Management Systems (WMS), as well as data-driven analytics support for decision-making. However, despite these promising benefits, the implementation of Web-Based TMS does not always run smoothly. Various studies report serious challenges such as low organizational readiness, user resistance to change, difficulties integrating with legacy systems, limited data quality, and increased security risks related to web-based architecture.

On the other hand, research related to Web-Based TMS is spread across various contexts and sectors, such as land and marine transportation, logistics, warehousing, and even institutional transportation (such as campuses and public services). These studies generally focus on specific aspects such as system development, implementation case studies, technical analysis, or evaluation of operational benefits. However, only a few studies have systematically synthesized these findings to provide a comprehensive view of trends, implementation patterns, challenges, and strategic implications of Web-Based TMS in the broader transportation industry.

This research gap forms the basis for conducting a Systematic Literature Review (SLR). Through the SLR approach, this study seeks to systematically collect, evaluate, and synthesize research findings related to the implementation of Web-Based Transportation Management Systems published from 2020 to 2025. This approach enables the identification of common patterns, clusters of findings, and key factors influencing the success or failure of web-based TMS implementation.

Specifically, this study aims to:

1. Identify development trends in the implementation of Web-Based TMS across transportation sectors;
2. Analyze the main benefits gained from the application of web-based TMS, especially in operational visibility and system integration;
3. Examine implementation challenges involving organizational readiness, data integration, and system security; and
4. Construct a conceptual synthesis that may serve as a reference for researchers and practitioners in developing and effectively implementing web-based TMS.

Thus, this research is expected to provide theoretical contributions in the form of a current knowledge map regarding Web-Based TMS as well as practical contributions as a reference for

transportation organizations in planning, implementing, and optimizing web-based transportation management systems in the digital era.

METHODS

This study employs a Systematic Literature Review (SLR) approach by referring to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines (Page et al., 2021). This approach was chosen to ensure transparency, replicability, and accountability in the identification, selection, and synthesis of literature related to the implementation of Web-Based Transportation Management Systems (TMS) in the transportation industry.

The focus of the review is directed towards academic publications and scientific sources that discuss topics related to the implementation of web-based TMS, web/cloud system architecture, API/ERP integration, fleet management, logistics digitalization, as well as organizational and data security challenges within the context of transportation.

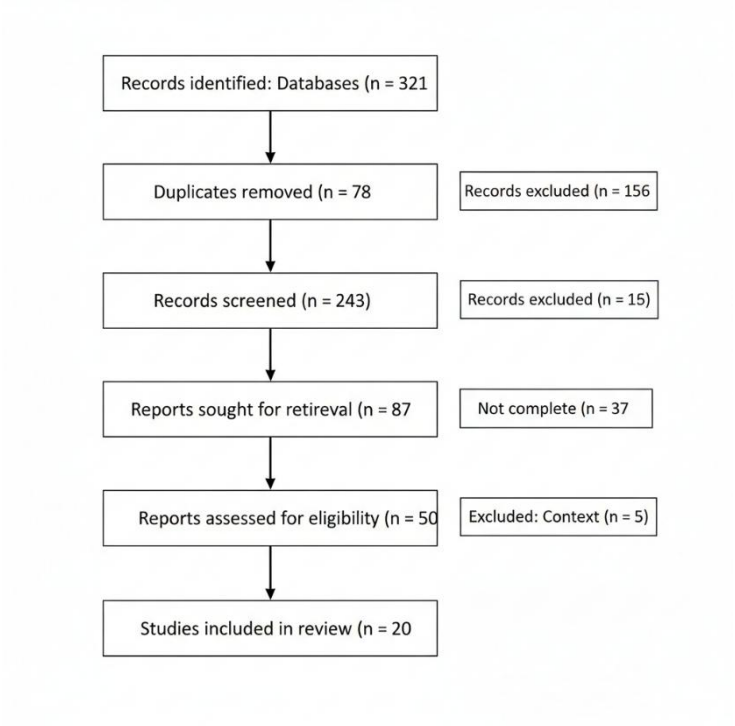

Figure 1. Prisma Diagram

The study selection process consisted of four stages: identification, screening, retrieval, and eligibility assessment. In the identification stage, the initial search results from databases yielded 321 records. After duplicate removal (n = 78), 243 unique records remained for further processing. The screening stage was then conducted, in which 156 records were excluded, leaving 87 reports considered potentially relevant and sought for retrieval. Among these, 37 reports could not be retrieved completely (Not complete), leaving 50 reports for eligibility assessment. Subsequently, the eligibility assessment based on full-text review resulted in 20 studies that met the inclusion criteria. Meanwhile, 30 other reports were excluded at this final stage (including 5 reports excluded for “Context”).

RESULT AND DISCUSSION

The literature selection process resulted in 20 articles that met the inclusion criteria and were relevant to the topic of implementing Web-Based Transportation Management Systems (TMS). All articles were published between 2020 and 2025, indicating that discussions on web-based TMS have increasingly developed over the past five years in line

with the rise of logistics digitalization and the integration of cloud-based systems.

Tabel 1. Hasil SLR

No	Researchers & Year	Research Focus	Research Method	Key Findings
1	Al-Hawari, F., Al-Refai, M., & Barham, H. (2020)	Web-based information system	System design & validation	Demonstrates an initial architecture for developing a web-based TMS.
2	Dorofeev, A., Sokolov, B., & Ivanov, D. (2024)	TMS & process mining	Dispatcher log analysis	Operational efficiency improved through data-driven process analytics.
3	Sattayathamrongthian, M. (2022)	TMS technology adoption	Organizational factor analysis	Organizational digital readiness significantly influences TMS implementation success.
4	Kumar, R., Sharma, P., & Singh, A. (2022)	Web-based TMS development	System design & implementation	Web-based TMS improves basic tracking automation and scheduling.
5	Anizal, A., Ramli, M., & Saputra, D. (2021)	Water transportation	e-Water TMS implementation	Web-based visualization for water transport fleets enhances monitoring capability.
6	Markov, I., Petrov, S., & Kuznetsov, A. (2022)	Freight forwarding	Cloud-based TMS modernization	Large-scale organizations gain benefits from real-time tracking.
7	Kütahya, S., Demir, E., & Aydın, O. (2025)	TMS evaluation	Multi-Criteria Decision Making	Core TMS selection factors are system features, cost, and integration capabilities.
8	Fagerberg, J. (2023)	Manufacturing industry	Implementation case study	Main challenges include system integration and business process change.
9	Rahman, A., Hossain, M., & Islam, S. (2023)	Small-scale logistics	Web-based TMS prototype	Node.js improves interface flexibility and system performance.
10	Prasetyo, D., Nugroho, A., & Santoso, B. (2023)	Maritime transportation	Laravel-based TMS implementation	System supports voyage documentation and

No	Researchers & Year	Research Focus	Research Method	Key Findings
				operational management.
11	Zuhriansyah, R. (2024/2025)	Land transportation	SWOT analysis	Web-based TMS enhances visibility and operational control.
12	Abdullah, M., Hassan, R., & Karim, A. (2024)	Campus transportation	Fleet & scheduling system development	Campus transport service efficiency significantly increased.
13	Williams, T., Carter, J., & Brown, L. (2022)	Logistics industry	TMS modernization analysis	Modernizing TMS reduces costs and improves operational coordination.
14	Miller, D., Thompson, R., & Lewis, K. (2024)	Drayage/port	Specialized drayage TMS implementation	System meets specific operational needs of port carriers.
15	Patel, S., Mehta, R., & Verma, N. (2024)	TMS market analysis	Market & trend analysis	Trends show significant growth in the adoption of web and cloud-based TMS.
16	Johnson, M., Lee, H., & Park, S. (2021–2024)	Academic & prototype	System development (ASP.NET, Laravel)	Provides technical insight into core features of web-based TMS.
17	Ivanov, D., Petrova, E., & Smirnov, A. (2022–2024)	TMS vendors	Legacy-to-web migration	System modernization enhances operational efficiency and scalability.
18	Suryadi, A., Wibowo, H., & Pranata, R. (2024)	National logistics	TMS & ERP integration	System integration increases report accuracy and OKR achievement.
19	Hernandez, J., Lopez, M., & Garcia, P. (2019–2021)	Crisis logistics	Web-based system analysis	TMS is relevant for maintaining operational continuity during crises.
20	Gonzalez, R., Martinez, L., & Silva, P. (2021)	Technical implementation of web-based TMS	System implementation case study	Web-based TMS improves operational efficiency and overall transport visibility.

Web/Cloud Technology and Real-Time Visibility

The cluster of web and cloud technologies within TMS studies (Dorofeev et al., 2024; FreightWaves, 2022; Acropolium, 2022; IJARCCE, 2022; NationFleet, 2023; Anizal et al., 2021) indicates that the shift to web/cloud architecture has made TMS systems more flexible, easier to access, and capable of providing real-time visibility into fleets, routes, and freight movements. Web-based systems are able to integrate fleet sensors, GPS, and operational data directly, thereby improving an organization's ability to perform tracking and data-driven decision-making. In the context of modern logistics, real-time visibility becomes a core capability that determines operational responsiveness, the effectiveness of coordination, and the overall quality of transportation services. This transition shifts TMS from being merely a recording tool toward a web-based decision-support platform.

System Integration, Process Automation, and Digital TMS Ecosystems

Studies within the integration cluster (Kütahya et al., 2025; Fagerberg, 2023; Pos Indonesia, 2024; IJARSCT, 2023; PortPro, 2024; Studocu, 2021–2024) confirm that the strategic value of web-based TMS primarily lies in its ability to connect with various other digital systems. Integrations with ERP, WMS, third-party APIs, IoT sensors, and process-mining tools reduce data duplication, streamline information flow, and accelerate the automation of operational processes, such as scheduling, route optimization, digital documentation, and dispatcher decisioning. Web-based automation generates significant efficiency gains and strengthens cross-system coordination throughout digital logistics ecosystems. Web-based TMS has become the operational core of responsive logistics services whether for forwarding operations, seaport environments, or university fleet management with strong dependence on integrated data exchange.

Implementation Challenges: Organizational Readiness, Data Integration, and Web Security

Articles within the challenge cluster (Sattayathamrongthian, 2022; Fagerberg, 2023; Kütahya et al., 2025; IJARSCT, 2023; QKS Group, 2024; PortPro, 2024) indicate that the success of implementing web-based TMS depends not only on technical factors but also on managerial and organizational readiness. Users' digital readiness, workforce competencies, and the organization's capacity to conduct change management are major determinants. Integration with legacy systems also presents a significant issue, because many organizations still operate incompatible data structures within older systems, requiring standardization, staged migration, and data audits. From a security perspective, web-based TMS faces risks such as data breaches, API attacks, and unauthorized access. Therefore, Identity and Access Management (IAM), audit logs, encryption, and modern web security controls are necessary. This cluster emphasizes that TMS adoption is not just a technological matter, but also requires organizational preparedness, security risk management, and structured data governance.

Synthesis and Implications Across Clusters

Cross-cluster findings illustrate a consistent pattern regarding web-based TMS implementation across multiple transportation sectors (land, marine, campus, and general logistics). The transformation toward web-based TMS has become a dominant trend within the period 2020–2025, driven by the increasing need for operational transparency, cross-system integration, and logistics process automation. System integration emerges as the key determinant of how much benefit organizations can obtain from TMS, while organizational readiness and data security serve as balancing factors that determine implementation sustainability. Overall, web-based TMS can be understood as the foundation of modern digital transportation ecosystems, where real-time data, platform connectivity, and security controls determine organizational performance and logistics competitiveness.

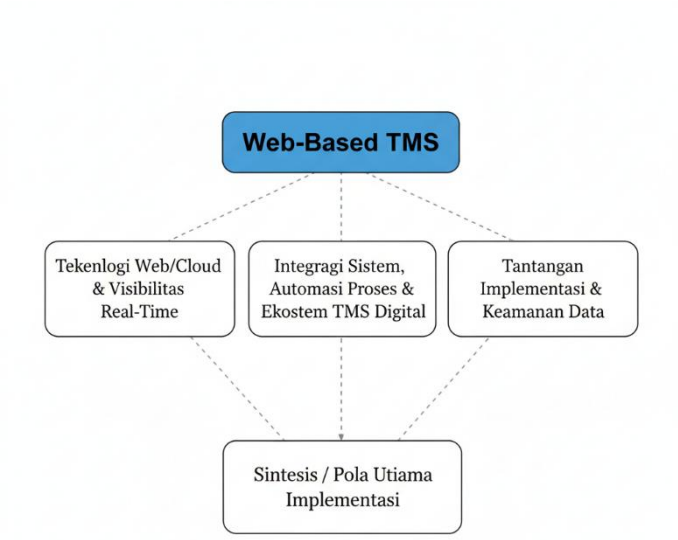

Figure 2. SLR Clustering Results

The first cluster highlights that the utilization of web and cloud technologies is the primary technical foundation for developing modern Transportation Management Systems (TMS). Studies from 2020–2025 affirm that web-based architectures enhance system accessibility, enable multi-location monitoring, and support feature updates without disrupting operations. Cloud technology also enables computational scalability and facilitates direct data processing from fleet devices such as GPS and vehicle sensors. Therefore, web-based TMS allows organizations to achieve higher levels of real-time visibility regarding routes, shipment status, and operational conditions, accelerating decision-making and improving distribution efficiency and service responsiveness. This cluster confirms that real-time visibility is not an optional feature, but a core capability that differentiates web-based TMS from conventional systems.

The second cluster illustrates that the success of Web-Based TMS implementation is strongly influenced by the system's ability to integrate with other digital platforms, including ERP, WMS, IoT, payment modules, and third-party APIs. This integration ensures data consistency throughout the logistics chain and reduces potential errors caused by manual entry. In addition, studies in this cluster emphasize the importance of automated processes, such as fleet scheduling, route optimization, digital document handling, and data-driven performance monitoring. Automation not only reduces manual workload but also increases operational speed and improves analytical decision-making quality. Overall, this cluster confirms that Web-Based TMS functions as part of a broader digital logistics ecosystem, where system interoperability is a strategic factor for establishing efficient and standardized workflows.

The third cluster demonstrates that implementation challenges of Web-Based TMS are not only technical, but also relate to organizational readiness, legacy system compatibility, and security risks within web-based architectures. Many studies show that limited digital skills, user resistance to change, and insufficient training represent major obstacles to adoption. From a technical perspective, incompatibility with legacy systems often requires phased migration and standardized information structures to ensure modern web compatibility. Security risks include API attacks, data breaches, and unauthorized access, which demand strict control measures within the web-based environment. Therefore, organizations must implement security mechanisms such as encryption, identity and access management (IAM), audit logging, and strict authorization controls. This cluster highlights that implementing Web-Based TMS requires balanced technical and managerial readiness to achieve optimal system outcomes.

Cross-cluster synthesis reveals that the implementation of Web-Based TMS is shaped by interactions among web-technology capabilities, the effectiveness of system integration and process automation, and organizational preparedness to address security and change-management requirements. The transformation toward web-based TMS has been a strong trend during 2020–2025, driven by the need for rapid operational visibility and integrated data across digital logistics ecosystems. However, its success depends on how well organizations can address structural and security challenges associated with transitioning to web-based architectures. This general pattern shows that modern TMS is no longer perceived merely as an operational tool, but as a strategic component that supports logistics digitalization through interoperability, automation, and real-time data.

Thus, the cross-cluster linkages indicate that implementing Web-Based TMS requires a comprehensive and complementary approach involving:

1. Web/Cloud Technologies, which provide foundational accessibility, scalability, and real-time visibility as the basis for operational decision-making;
2. System Integration and Process Automation, which ensure data consistency, efficient workflows, and the development of an end-to-end connected digital logistics ecosystem;
3. Implementation and Security Challenges, which highlight the importance of organizational readiness, structured legacy system migration, and strong data-security controls to ensure optimal TMS performance; and
4. Synthesis across these areas shows that the strategic value of Web-Based TMS can only be maximized when technology, integration, and security are managed simultaneously and in balance.

These overall findings emphasize that successful implementation of web-based TMS is not determined solely by technological sophistication, but also by the interaction between organizational readiness, system integration quality, data security, and the ability to use real-time visibility to support operations and decision-making.

Web-based TMS becomes effective only when technology, processes, and human resources are integrated into a single digital logistics ecosystem.

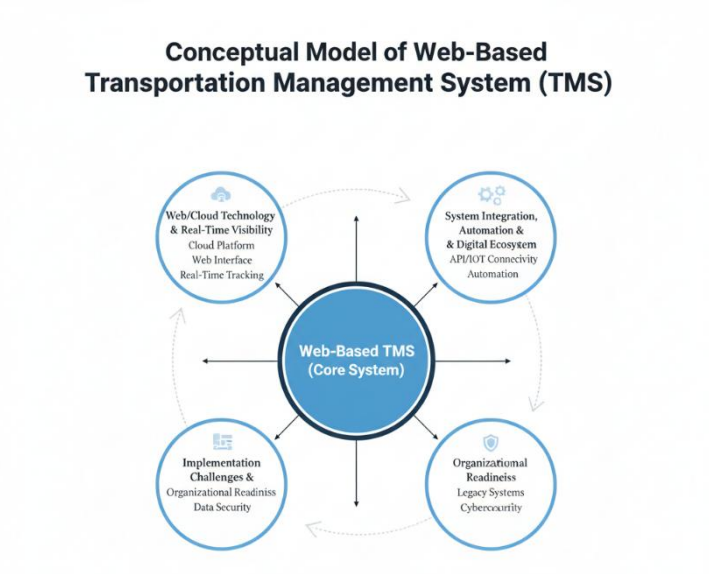

Figure 3. Conceptual Model of Web-Based TMS

The conceptual model developed from the synthesis of 20 studies places Web-Based

TMS as the central theme surrounded by three major clusters: (1) Web/Cloud Technology & Real-Time Visibility, (2) System Integration, Process Automation & Digital Logistics Ecosystems, and (3) Implementation Challenges & Data Security. These three clusters do not stand separately, but instead interact with one another to form a comprehensive framework explaining how web-based TMS is adopted, operated, and delivers strategic value to transportation organizations.

The Web/Cloud Technology & Real-Time Visibility cluster functions as the main technical foundation that enables TMS to gain flexibility, multi-device accessibility, and real-time monitoring capability over fleets, routes, and shipment status. This technology does not merely improve informational accuracy, but also strengthens organizational capacity to carry out rapid, data-driven decision-making.

Next, the System Integration and Process Automation cluster describes how the success of TMS relies heavily on the system's ability to connect with ERP, WMS, IoT sensors, and external APIs. This cluster demonstrates that modern TMS is part of a broader digital logistics ecosystem, where automated tasks such as scheduling, route optimization, and digital document creation function as key enablers that reduce manual workload and enhance transportation value-chain efficiency.

The third cluster, Implementation Challenges & Data Security, presents the dominant obstacles in TMS implementation. These challenges involve organizational readiness, user resistance, compatibility limitations with legacy systems, and increased security risks resulting from open web architectures. API security, IAM-based authentication, encryption, and access policies are critical elements for ensuring operational sustainability. Moreover, data migration and standardization are urgent requirements to ensure seamless cross-system integration.

The relationships among clusters are illustrated through interaction pathways within the model. For example, web/cloud technology directly relates to security: as system openness increases, the need for higher levels of data protection becomes unavoidable. Another interaction appears between automation and integration, both of which rely on strong digital architecture, as well as between organizational readiness and the effective utilization of real-time visibility technology can operate optimally only when users understand and manage the system features.

Therefore, this conceptual model confirms that the success of implementing Web-Based TMS is not determined merely by the quality of technology used, but by the synergy between technical foundations, cross-platform integration, automated processes, digital security, and comprehensive organizational readiness. This integrative approach forms the basis for transportation organizations to build adaptive and effective management systems aligned with the requirements of modern logistics digitalization.

CONCLUSION

The Systematic Literature Review (SLR) of 20 studies published between 2020–2025 shows that the implementation of Web-Based Transportation Management Systems (TMS) plays a strategic role in accelerating the digitalization of the transportation sector. Cross-literature synthesis reveals that Web-Based TMS is no longer merely an operational system for recording trips; instead, it has evolved into a digital platform enabling cross-system integration, real-time monitoring, and data-driven decision-making. Cluster findings indicate three major thematic groups that form the foundational understanding of modern TMS implementation.

First, web and cloud technologies offer flexibility, scalability, and real-time visibility capabilities that underpin TMS effectiveness. These capabilities enable organizations to monitor fleets, routes, vehicle loads, and shipment statuses directly, thereby improving information accuracy and the quality of decision-making. Second, the benefits of TMS are maximized when it can be integrated with other systems such as ERP, WMS, IoT sensors,

and third-party APIs. This integration drives automation of operational tasks, ensures data consistency, and creates an interconnected digital logistics ecosystem. Third, the success of implementation is strongly influenced by non-technical challenges, such as organizational readiness, resistance to change, limited digital competencies, as well as issues in data security and legacy system migration. This means that modern TMS requires a holistic approach that combines technological preparedness with governance and change management practices.

The conceptual model constructed from the synthesis of the three clusters shows that Web-Based TMS occupies a central position within the digital logistics ecosystem, with integration, automation, data security, and organizational readiness functioning as interacting elements. The pattern of inter-cluster relationships emphasizes that technology alone is insufficient; the success of TMS depends heavily on how organizations manage data integration, ensure security, and cultivate a work culture that adapts to digital technologies.

Overall, the findings indicate that web-based TMS serves as a key component for improving operational efficiency, managerial effectiveness, and analytical capabilities in the transportation sector. However, challenges such as interoperability, data standardization, and security require serious attention to ensure sustainable TMS adoption. For future research, large-scale longitudinal studies are needed to evaluate the long-term impact of Web-Based TMS, as well as in-depth exploration of digital security, data interoperability, and integration of emerging technologies such as AI and IoT within transportation management contexts.

Thus, the successful implementation of Web-Based TMS is achieved through an integrative approach that unifies technological aspects, organizational processes, security governance, and human resource readiness. This holistic approach becomes an essential foundation for logistics and transportation organizations as they respond to modern digitalization demands.

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