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Digital Transformation of Supply Chain Resilience: By Transport Management System (TMS) in The Logistics' Industry

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Abstract

This study examines the role of Transport Management Systems (TMS) as digital tools, in achieving the effectiveness of contemporary supply chains. The core debate is around the use of these technologies to gain leverage in a connected logistics ecosystem. It was shown that with Transport Management Systems (TMS) implementation one can achieve real-time visibility, optimize current operational processes, and automate the full range of logistics operations. Such systems provide capabilities such as tracking shipments, determining routes, selecting vendors automatically, and consolidated reporting. Internet of Things (IoT) technologies further improves system security and predictive analytics. Results suggest that the digital transformation of the logistics domain does not only increase the competitiveness of a company, it also increases the quality of services and the ability to take faster data-based decisions. With the growth of supply chains, the strategic use of information becomes more difficult to achieve. Digitalization transformation in logistics sector through the implementation of Transport Management Systems (TMS) has proven to have a significant impact on operational efficiency, accuracy, visibility and effectivity.

keywords: Transport Management Systems; Warehouse Management Systems; Digitalization of Logistics; Supply Chain; System Integration

INTRODUCTION

The growth of digital tech has much swayed different fields, mostly logistics and supply chain care. In this place, today's fast market state, going digital has moved from being a plan choice to a must for getting exact, strong, and good operations. In the delivery field, digital change features the joining of tech like IoT tools, up-to-the-minute data checks, and linked admin systems that make the whole sending method easier.

A major part of this online change is the use of Transport Management Systems (TMS). These systems are very helpful in improving how things work like order handling, fleet oversight, and performance analytics. TMS manages transportation which includes planning, execution, and delivery tracking that helps make warehouse operations better like storage sorting and working with distribution mechanisms.

The TMS adds a lot to how well the supply chain works by making visibility better, optimizing inventory levels, improving transportation plans, and reducing costs. In today's tough market, businesses need flexible and quick supply networks that are also cheap and can handle risks coming from inside the company as well as outside.

The urgency of this research is amplified by several converging factors. The rapid growth of e-commerce (Indonesian e-commerce market projected to reach USD 95 billion by 2025) has created unprecedented demand for integrated logistics solutions. Customer expectations for same-day or next-day delivery, real-time tracking, and transparent communication cannot be met by fragmented TMS-WMS systems. The Indonesian government's "Making Indonesia 4.0" roadmap prioritizes logistics digitalization as a key enabler for manufacturing competitiveness. Furthermore, post-pandemic supply chain disruptions have highlighted the need for resilient, visible, and agile logistics networks that integrated TMS-WMS systems can provide. Without analytical frameworks to guide TMS development and evaluation, companies risk investing in digital solutions that do not address their most critical operational needs.

The novelty of this research lies in five aspects. First, it proposes a new composite metric—the Warehouse-Transport Efficiency Index (WTEI)—that simultaneously measures both warehouse accuracy and transportation timeliness, providing a single score (0-1) for TMS-WMS integration quality. Second, it integrates multiple analytical techniques (WTEI, load-distance, centre of gravity, forecasting comparison, QFD) into a unified framework for logistics decision-making, demonstrating how each technique addresses different logistics challenges (integration measurement, location selection, demand prediction, feature prioritization). Third, it provides quantitative illustrative examples for each technique (WTEI = 0.931, inventory turnover = 6x/year, centre of gravity coordinates (173.33, 116.67), moving average MSE = 879.32 vs. exponential smoothing MSE = 1377.62, QFD technical priorities = Realtime Fleet Tracking Module priority 1) that can serve as benchmarks for logistics practitioners. Fourth, it applies QFD specifically to TMS development, identifying that Automatic Notifications, User-Friendly Interface, and Real-Time GPS Tracking are highest customer priorities, with Realtime Fleet Tracking Module achieving the highest technical importance score (172). Fifth, it demonstrates the application of moving average forecasting (producing 233.00 next-period forecast) versus exponential smoothing (214.37) for logistics demand, with MSE comparison validating moving average superiority for stable demand patterns.

The purpose of this research is to examine the role of Transport Management Systems (TMS) as digital tools in achieving supply chain effectiveness. The specific objectives are: (1) to develop and demonstrate the Warehouse-Transport Efficiency Index (WTEI) for measuring TMS-WMS integration quality; (2) to demonstrate load-distance analysis and centre of gravity method for distribution centre location optimization; (3) to compare moving average and exponential smoothing forecasting methods for logistics demand prediction; and (4) to apply Quality Function Deployment (QFD) for TMS feature prioritization based on customer requirements.

The objective of the current research is to explore the benefits of unification of TMS for enhancing operational performance, reducing costs by increasing efficiencies in supply chain processes. It focuses on the added value resulting from the interdependence of these systems in increasing the efficiency of operations, minimizing costs, and improving service. The study also looks into how they can bring enhance transparency and by this support an information-based policy-making concerning supply chains what could lead to more effective and more strategic supply chain practices.

METHOD

According to Fiksel et al. (2015), defined supply chain resilience as the ability of firms in the supply chain to prepare, resist, adapt and recover in the original or even better state before and after disruptions. In line with originated from ecology (Walker et al. 2002), psychology (Barnett and Pratt 2000), metallurgy (Callister and Rethwisch 2003) and management (Hamel and Valikangas, 2003). Furthermore, it refers to the adaptive capability of the supply chain to prepare for unexpected events, respond to disruption and recover from them by maintaining continuity of operations at the desired level of connectedness and control over structure and function (Ponomarov and Holcomb, 2009).

Refer to Sprague (2007), defines how the field of Operations Management (OM) has evolved over time from focusing purely on manufacturing and production to covering a much broader range of activities, including services, supply chains, technology integration, and information management. Similarly with Karmarkar & Apte (2007), which highlight that information itself has become a critical part of operations-changing how businesses design, manage, and optimize their processes.

Data Collection and Analysis Techniques

Warehouse-Transport Efficiency Index (WTEI)

Parmenter (2015) asserts that the creation of composite key performance indicators (KPIs) that encompass several important aspects like warehouse operations metrics (e.g. throughput, picking accuracy, and dock-to-stock time) in the Warehouse-Transport Efficiency Index (WTEI). Integrating TMS and WMS that synchronized the operations' data of transportation and warehouse. The data collection techniques are:

Table 1. Data Collection Techniques

No.	Technique	Purpose
1	Barcode Scanning	Capture product movement in warehouses efficiently
2	RFID (Radio Frequency Identification)	Real-time tracking of inventory and vehicles
3	IoT Sensors	Monitor fleet movement, warehouse temperature, vehicle status
4	Telematics Systems	Provide GPS location, vehicle performance, driver behavior
5	Electronic Data Interchange (EDI)	Automated exchange of order, shipment, and inventory data
6	Mobile Data Collection	Apps for drivers and warehouse staff to update status instantly
7	Cloud-based ERP Integration	Synchronizes WMS and TMS data flows into a single platform

In addition, integrating system as a simple but powerful formula widely used to measure efficiency by using formula Warehouse-Transport Efficiency Index (WTEI), as below:

$$WTEI = \frac{\text{Total On-Time Deliveries (TMS Data)} \times \text{Total Inventory Accuracy (WMS Data)}}{\text{Total Orders Processed}}$$

Where:

a. **Total On-Time Deliveries**: From TMS (transport KPIs)
b. **Total Inventory Accuracy**: From WMS (warehouse KPIs)
c. **Total Orders Processed**: Number of customer orders handled

Projected Supply Chain Resilience

Effective supply chain flow raises sales volume and lowers average inventory levels, which raises inventory turnover, a crucial operational resilience indicator, according to Chopra and Meindl (2019).

Projected Inventory Turnover Rate Formula:

$$\text{Inventory Turnover} = \frac{\text{Cost of Goods Sold (COGS)}}{\text{Average Inventory}}$$

Where :

a. COGS increases because of higher sales.
b. Average Inventory decreases due to better flow.
c. Result: Higher Inventory Turnover.

Supply Chain Resilience Improvement

According to Christopher and Peck (2004), improving supply chain resilience requires creating more flexible, agile, and visible networks to respond rapidly to disruptions related to the dimension of visibility, responsiveness, risk management, cost efficiency and satisfaction.

Inclusion and Exclusion Criteria

The analysis was limited to content directly relevant to TMS, WMS, and supporting modules such as VMS (Vendor Management System) and DMS (Delivery Management System). Non-specific information which does not contribute to this study's analytical focus was excluded to maintain relevance and clarity.

RESULTS AND DISCUSSION

The Strategy for Operational Excellence

According to (Hayes and Wheelwright, 1984), while the more mature and proactive operations, which the greater is the competitive edge for achieve company gains. Defining the aspects of competitive edge that integrated to the logistics application as below:

Table 2. Integration to achieve Competitive Edge

No.	Aspect	Hayes & Wheelwright (1984)	Logistics Application (Today)
1	Competitive Focus	Operations must drive strategy	TMS & WMS must drive logistics leadership
2	Key Mechanism	Operational excellence + Strategic alignment	Real-time, accurate, fast, flexible logistics
3	Expected Result	Sustained competitive advantage	Logistics becomes a market differentiator

Mapping the solutions into stages of operational effectiveness each which describes as following picture:

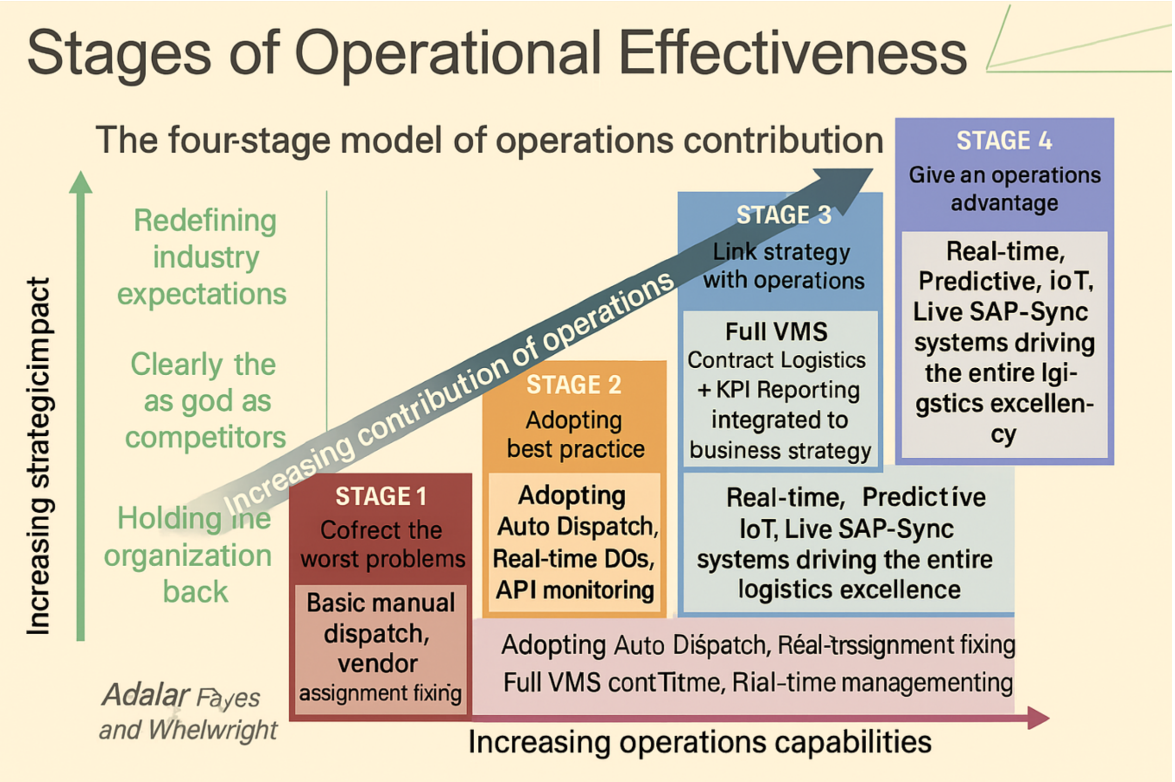


Figure 1. Stages of Operational Effectiveness

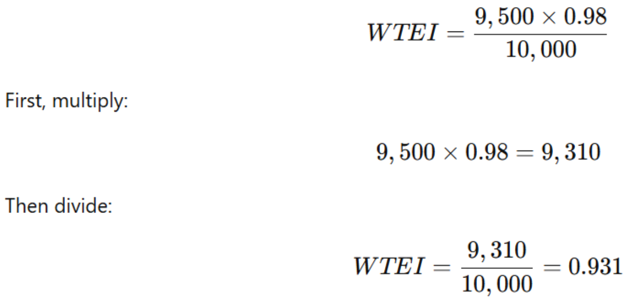
Warehouse-Transport Efficiency Index (WTEI)

Interpretating that **Higher WTEI** shows a better TMS & WMS integration quality (high accuracy and timely deliveries), conversely when **Lower WTEI** refer to the issues in coordination between warehouse and transport operations. For instance, knowing as below:

Table 3 Warehouse-Transport Efficiency Index (WTEI) Calculation Inputs

No.	Metric	Value
1	Total On-Time Deliveries	9,500 deliveries
2	Total Inventory Accuracy	98% = 0.98 (expressed as decimal)
3	Total Orders Processed	10,000 orders

Substitute the values into the formula above, the result are:



$$WTEI = \frac{9,500 \times 0.98}{10,000}$$

First, multiply:

$$9,500 \times 0.98 = 9,310$$

Then divide:

$$WTEI = \frac{9,310}{10,000} = 0.931$$

The result means that the integrated TMS & WMS system is performing very well by achieving 0,931 or 93.1% combined operational efficiency. It gives several benefits for the business Impact included high reliability in delivering orders on time, high accuracy in inventory management and highly strong coordination between warehouse and transportation. Hence, if WTEI were closer to 1.0 (100%), it indicates to the perfect efficiency.

Projected Supply Chain Resilience

By integrating Transport Management System (TMS) and Warehouse Management System (WMS) can enhance flexibility, visibility, and responsiveness across supply chains including, Inventory Turnover, Order Fill Rates, Inventory Accuracy, Cycle Time and Return on Investment (ROI). Projected example as following:

Table 4. Projected Supply Chain Resilience

No.	Metric	Before Integration	After Integration	Impact Explanation
1	Inventory Turnover	5 times/year	8 times/year	Faster movement of goods, less overstock
2	Customer Order Fill Rate	85%	98%	Real-time visibility improves fulfillment
3	Inventory Accuracy	90%	99.50%	Barcode/RFID improves stock counting accuracy
4	Cycle Time (Order to Dispatch)	72 hours	24 hours	Dispatch automation reduces delay
5	Average Days to Sell Inventory	73 days	45 days	Better stock management reduces holding time
6	Cost of Carrying Inventory	25% of value	15% of value	Lower storage costs from faster turnover
7	Return on Investment (ROI)	8%	15%	Improved operational efficiency boosts returns

For example, knowing as below:

Table 5 Inventory Turnover Calculation Inputs

No.	Item	Value
1	Cost of Goods Sold (COGS)	$9,000,000
2	Beginning Inventory	$1,800,000
3	Ending Inventory	$1,200,000

Step 1: Calculate Average Inventory

$$\text{Average Inventory} = \frac{\$1,800,000 + \$1,200,000}{2} = \frac{\$3,000,000}{2} = \$1,500,000$$

Step 2: Calculate Inventory Turnover

$$\text{Inventory Turnover} = \frac{\$9,000,000}{\$1,500,000} = 6$$

The result shows that inventory turnover is 6 times per year. It means that the company sells and replenishes its average inventory six times per year. If turnover was around 4–5 before the integration, then after increasing to 6, it illustrates a very clear improvement due to the TMS and WMS streamline to the supply chain effectively.

Supply Chain Resilience Improvement

According to Christopher and Peck (2004), improving supply chain resilience requires creating more flexible, agile, and visible networks to respond rapidly to disruptions related to the dimension of visibility, responsiveness, risk management, cost efficiency and satisfaction.

Table 6. Supply Chain Resilience Improvements

No.	Dimension	Pre-Integration	Post-Integration
1	Visibility	Fragmented, manual	Full real-time dashboard
2	Responsiveness	Delayed shipment response	Instant dispatch adjustment
3	Risk Management	Reactive	Preventive with real-time alerts
4	Cost Efficiency	High carrying costs	Lower carrying and shipping costs
5	Satisfaction	Moderate (85% fill rate)	High (98% fill rate)

Operational Efficiency through Load Distance

Considering the selection of a primary logistics centre between two alternative locations for sample. To support this decision, a quantitative analysis was conducted using the Load × Distance (LD) approach, which calculates efficiency based on a combination of cargo volume (in kilograms) and travel distance (in kilometers) for each delivery route served by the two distribution centres. This approach serves as the basis for evaluating how effectively each area can distribute goods with maximum efficiency, below is the example:

Table 7. Load distance calculation

Springfield	*6*	*6,5*			
City (Name)	**City (X)**	**City (Y)**	**RD**	**Load**	**LD**
Last Mile Delivery	3	6	3,5	4	**14**
Middle Mile Transfer	4	1	7,5	12	**90**
Warehouse Attainment	10	7	4,5	10	**45**
Express Courier	11	22	20,5	15	**307,5**
			456,5		
Mansfield	*11*	*14*			
City (Name)	**City (X)**	**City (Y)**	**RD**	**Load**	**ld**
Last Mile Delivery	3	6	16	4	**64**
Middle Mile Transfer	4	1	20	12	**240**
Warehouse Attainment	10	7	8	10	**80**
Express Courier	11	22	8	15	**120**
			504		

By integrating this approach into the Transport Management System (TMS), decisions regarding the placement of distribution centres, route planning, and fleet allocation can be made in a more objective, measurable manner—supporting the long-term optimization of operational costs.

Distribution Centre Point Analysis using the Centre of Gravity Method

Referring to (Ballou, 2004), explains the Centre of Gravity (CoG) method as a mathematical technique to locate warehouses or distribution centres optimally based on transportation costs and demand points. In line with (Chopra and Meindl, 2019), describe that the Centre of Gravity method as a **critical quantitative tool** for finding facility locations to minimize weighted distance or cost across customer locations. Similarly, with (Rushton et.al., 2017), cover the distribution network design and describe the Centre of Gravity method as part of best practices for warehouse and distribution centre planning. It includes practical applications of location analysis like the Centre of Gravity method in designing world-class supply chain networks (Frazelle, 2002). For instance, while knowing such below:

Table 8 Distribution Centre Data for Centre of Gravity Analysis

No.	Distribution Centre	Daily Outbound Volume (units)	X-Coordinate	Y-Coordinate
1	DC1	2000	300	100
2	DC2	1500	200	50
3	DC3	4000	100	150

The combination of position and weight is then used to determine the weighted midpoint, which mathematically represents the centre of gravity of the distribution network by the following pattern:

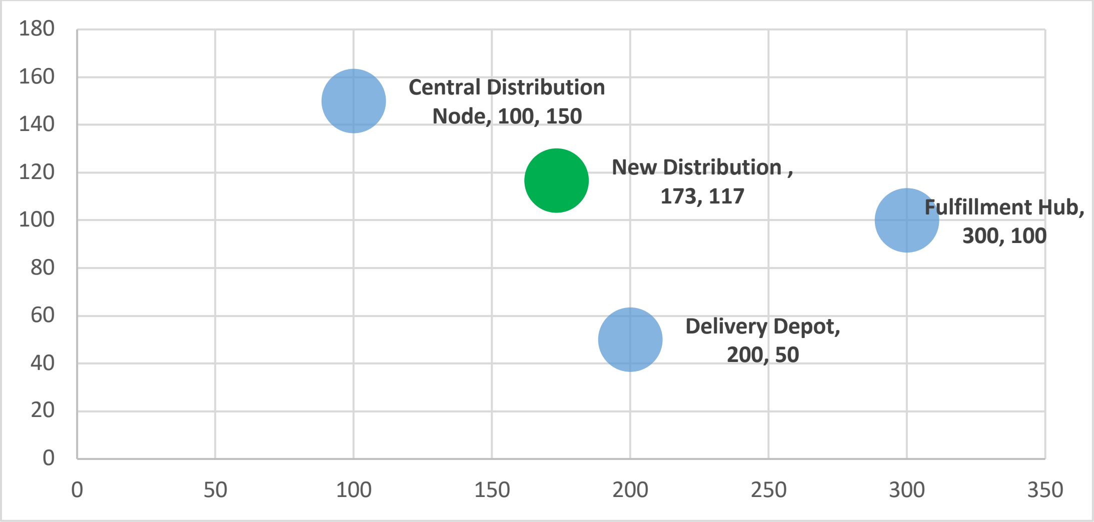


Figure 6. Chart of Distribution Centre Positions and Volumes Using the Centre of Gravity Method

Based on the calculations using the Centre of Gravity (CoG) approach, the new distribution centre coordinates are determined to be at X = 173.33 and Y = 116.67. This result represents that the most geographically optimal location for a new distribution centre, as it minimizes the total shipping distance to all demand points. This finding serves for Establishing TMS which encourage company to evaluate the efficiency of its existing distribution centres and to adapt the design of measurable logistics network expansion effectively and efficiently.

Analysis of Demand Forecasting

Based on the theory of (Makridakis et.al., 1998), which moving average and exponential smoothing compared the stability and responsiveness to data changes. Strengthen by (Hyndmand and Athanasopoulos, 2021), while up-to-date resource that clearly describes simple moving averages and exponential smoothing with practical examples. Similarly to (Stevenson, 2020) and (Chase, 2013), that forecasting techniques in operations, including moving averages and exponential smoothing, with emphasis on choosing methods based on data patterns. Below are the sample forecasting related to the TMS based on the time period and the observation.

Table 9. Forecast Calculation Using the Moving Average Method

Time Period	Moving Average Observation	Moving Average Forecast	Exponential Smoothing Observation	Exponential Smoothing Forecast
1	124		124	124.00
2	153		153	124.00
3	143	138.50	143	129.80
4	117	148.00	117	132.44
5	186	130.00	186	129.35
6	192	151.50	192	140.68
7	214	189.00	214	150.95
8	224	203.00	224	163.56
9	237	219.00	237	175.64
10	248	230.50	248	187.92
11	202	242.50	202	199.93
12	181	225.00	181	200.35
13	199	191.50	199	196.48
14	210	190.00	210	196.98

Time Period	**Moving Average Observation**	**Moving Average Forecast**	**Exponential Smoothing Observation**	**Exponential Smoothing Forecast**
15	218	204.50	218	199.59
16	233	214.00	233	203.27
17	189	225.50	189	209.21
18	195	211.00	195	205.17
19	221	192.00	221	203.14
20	245	208.00	245	206.71
Next period forecast, time period 21		233.00		214.37
MSE		879.32		1377.62

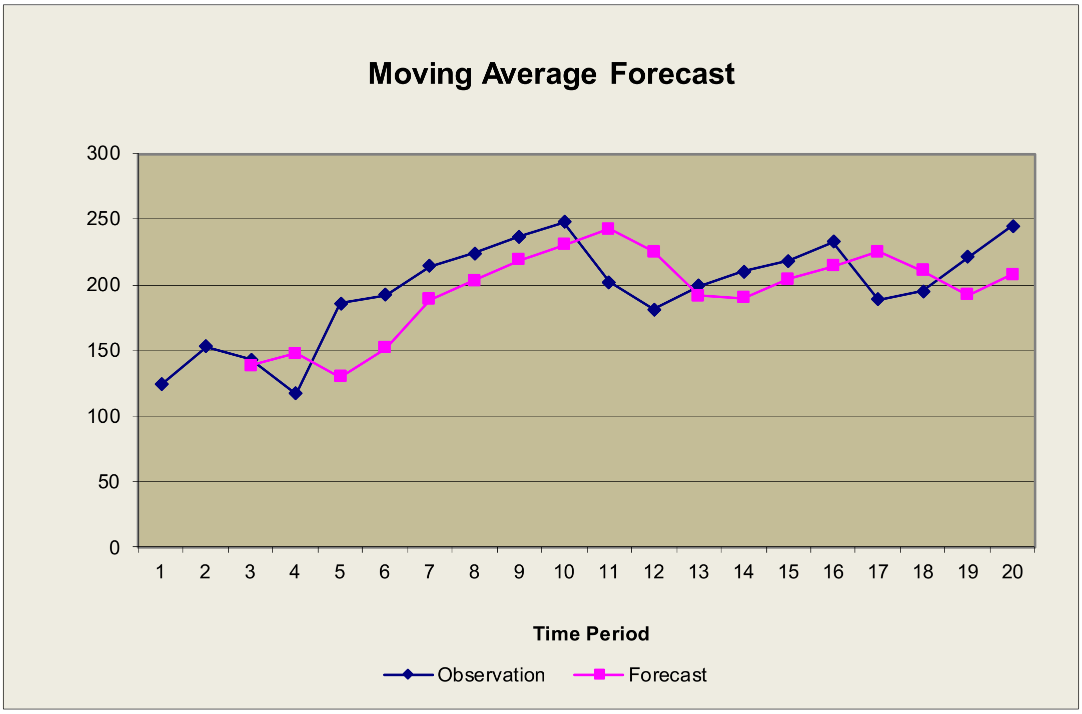


Figure 7. Moving Average Forecast

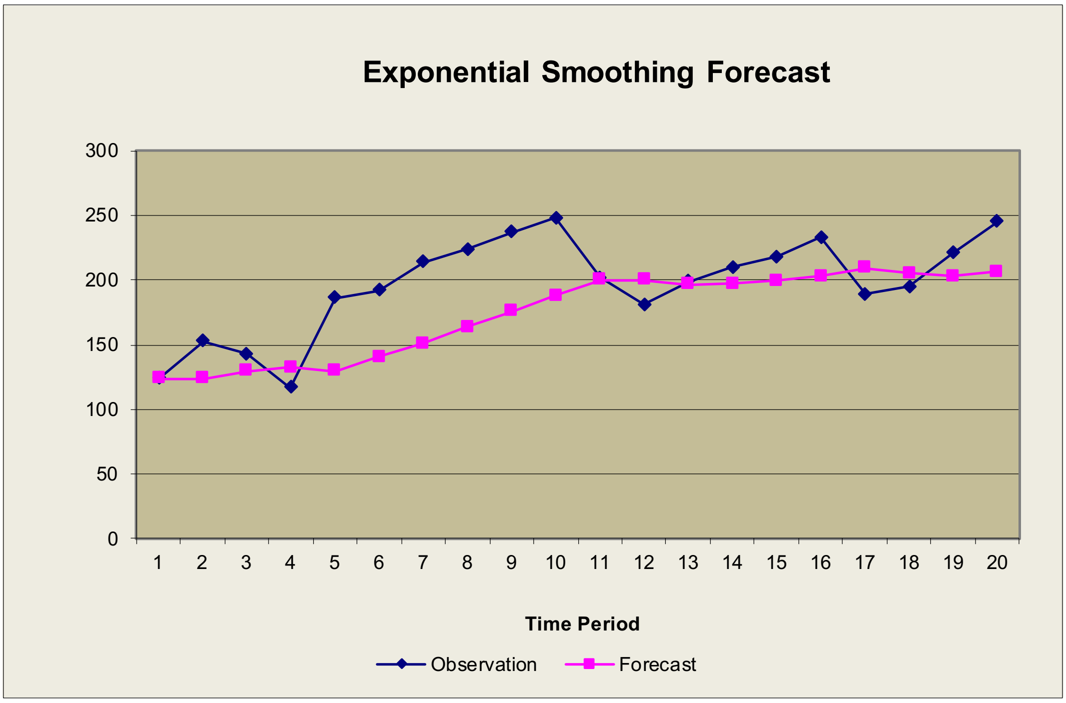


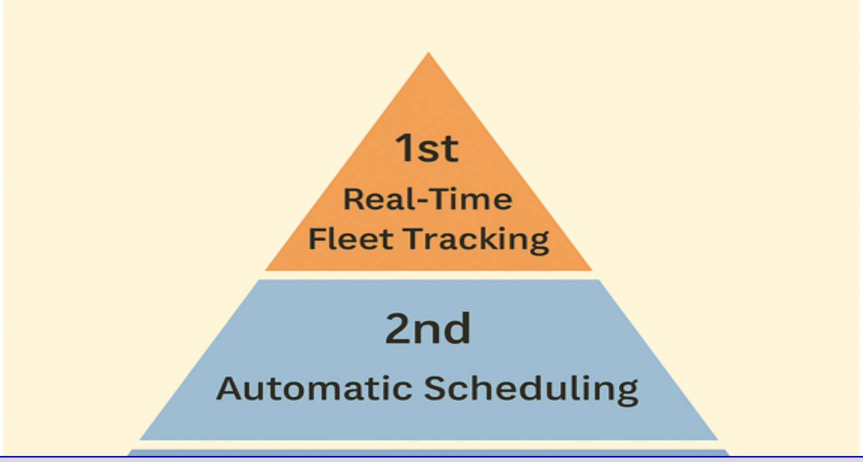
Figure 8. Exponential Smoothing Forecast

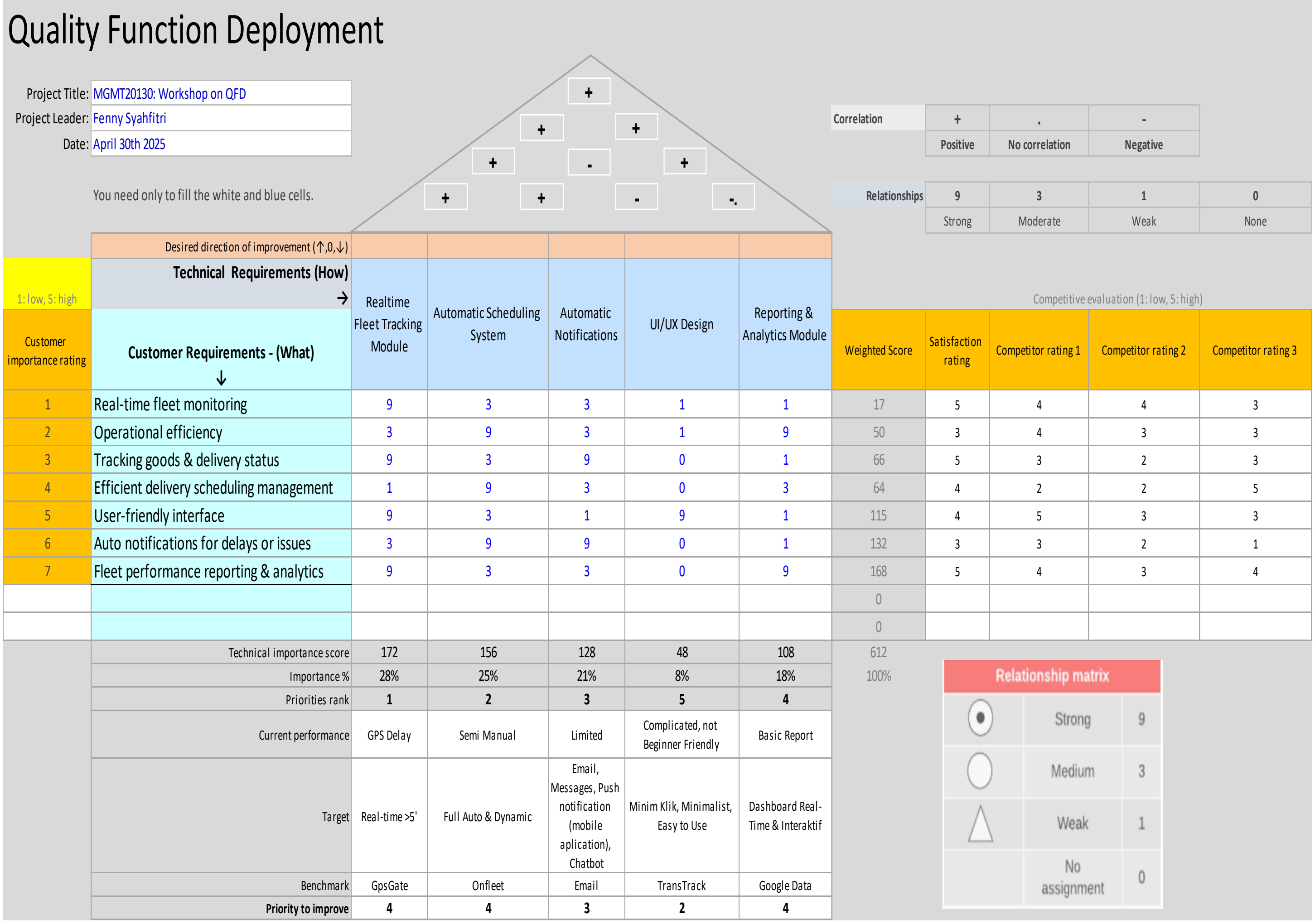
Comparing both of forecasting methods analysis, the result shows that the moving average yields a significantly lower Mean Squared Error (MSE) of 879.32 compared to 1377.62 for exponential smoothing, which indicating a greater forecast accuracy. This result projects a higher value for the next period by 233.00 divide to exponential smoothing by 214.37. According to Hyndman and Athanasopoulos (2018), the advantage of moving average in this case that asserts more effective for datasets without pronounced trends, offering a more responsive and stable forecast by equally weighting observations recently. Refer to Makridakis et.al., (2020), on the other hand, exponential smoothing with a low α tends to underreact to changes, which creating forecast lag in dynamic environments. Hence, the moving average method is recommended as the optimal approach to support accurate short-term planning and forecasting tend to Transport Management System in logistic sector.

Quality Function Deployment (QFD) Analysis for TMS Development

Quality Function Deployment (QFD) translates the customer needs into technical design specifications (Akao, 1990). QFD based on House of Quality (HoQ) is applied to product and system development by connecting customer requirements directly to engineering characteristics (Hauser and Clausing, 1988). Prioritizing features and optimizing resource allocation in development projects by QFD (Chan and Wu, 2002). In addition, QFD also enhances product and system development, linking it to broader quality management strategies (Zairi and Youssef, 1995).

This method is crucial because system development resources and time are often limited, meaning that every technical decision must focus on aspects that have the greatest impact on end-user satisfaction. Below are the example of House of Quality for Transport Management System (TMS) :





Quality Function Deployment

Project Title: MGMT20130: Workshop on QFD
Project Leader: Fenny Syahfitri
Date: April 30th 2025

You need only to fill the white and blue cells.

Correlation	+	.	-
	Positive	No correlation	Negative

Relationships	9	3	1	0
	Strong	Moderate	Weak	None

	Desired direction of improvement (↑,0,↓)										
1: low, 5: high	Technical Requirements (How) →	Realtime Fleet Tracking Module	Automatic Scheduling System	Automatic Notifications	UI/UX Design	Reporting & Analytics Module	Competitive evaluation (1: low, 5: high)				
Customer importance rating	Customer Requirements - (What) ↓						Weighted Score	Satisfaction rating	Competitor rating 1	Competitor rating 2	Competitor rating 3
1	Real-time fleet monitoring	9	3	3	1	1	17	5	4	4	3
2	Operational efficiency	3	9	3	1	9	50	3	4	3	3
3	Tracking goods & delivery status	9	3	9	0	1	66	5	3	2	3
4	Efficient delivery scheduling management	1	9	3	0	3	64	4	2	2	5
5	User-friendly interface	9	3	1	9	1	115	4	5	3	3
6	Auto notifications for delays or issues	3	9	9	0	1	132	3	3	2	1
7	Fleet performance reporting & analytics	9	3	3	0	9	168	5	4	3	4
							0				
							0				
	Technical importance score	172	156	128	48	108	612				
	Importance %	28%	25%	21%	8%	18%	100%				
	Priorities rank	**1**	**2**	**3**	**5**	**4**					
	Current performance	GPS Delay	Semi Manual	Limited	Complicated, not Beginner Friendly	Basic Report					
	Target	Real-time >5'	Full Auto & Dynamic	Email, Messages, Push notification (mobile aplication), Chatbot	Minim Klik, Minimalist, Easy to Use	Dashboard Real-Time & Interaktif					
	Benchmark	GpsGate	Onfleet	Email	TransTrack	Google Data					
	Priority to improve	**4**	**4**	**3**	**2**	**4**					

Relationship matrix		
⊙	Strong	9
○	Medium	3
△	Weak	1
	No assignment	0

Figure 10. House of Quality Matrix for Transport Management System (TMS)

The matrix of House of Quality (HoQ) above illustrates a structured and clear roadmap for the Transport Management System (TMS). Based on the QFD results, the top priorities for improving TMS are Automatic Notifications, User-Friendly Interface, and Real-Time GPS Tracking. Reflecting customer needs for an informative, easy-to-use system that provides delivery transparency. Compared to competitors, it shows highly potential, but needs more improvement in these core features to elevate its competitiveness in the digital logistics market. The relationship matrix highlights the strength of these connections, with the Realtime Fleet Tracking Module achieving the highest technical importance score (172) and ranking first in priority, followed by

Automatic Scheduling (156) and Notifications (128). Ultimately, this QFD framework offers a strategic blueprint, guiding resource allocation toward high-impact technical improvements, ensuring that development efforts are customer-driven, competitively aware, and focused on achieving measurable performance gains.

CONCLUSION

Digitalization transformation in logistics sector through the implementation of Transport Management Systems (TMS) has proven to have a significant impact on operational efficiency, accuracy, visibility and effectivity. The system not only to enable real-time monitoring of the flow of goods, but also provides analytical data that forms the basis for smarter decision-making. Managing and tracking logistics operations which up-to-date is extremely crucial for corporates that enhancing the operational performance and service delivery in a rapid-competitive market.

Description and results Based on the analysis and results, calculations such as gravity centre calculations or load-distance analysis are possible in order to differentiate the ideal termination for the distribution centre. With these techniques, companies are able to decrease their transportation costs by identifying locations that will minimize the total cost of logistics. In addition, accurate demand prediction plays a key role to the efficient stock management and smooth business operations. Companies that improve their demand forecasting capability can optimize inventory, prevent stock outs or overstock, and be more agile in reacting to shifts in the market.

Productivity and logistics performance speed assessments demonstrate that KPIs based on analytics can disclose hidden inefficiencies in our operations. They could cause service delays, increased costs, and damage to supply chain efficiency. By pinpointing these inefficiencies, companies are enabled to make specific interventions and streamline processes. Furthermore, by the House of Quality method, the TMS system has been found to result in increased service level in accordance with the customers' desires like on-time in delivery and a good Service Level Agreement (SLA), which leads to the timely deliveries. Logistics alignment to client requirements is key to customer satisfaction and for gaining an edge over competition over the long term.

Transport Management Systems (TMS) has emerged as a pivotal strategy for enhancing operational efficiency, responsiveness, and cost-effectiveness in today’s dynamic supply chain landscape. Through this study, it is evident that the synchronization of these systems not only improves real-time visibility and automation but also strengthens the resilience and agility of supply networks. Metrics such as the Warehouse-Transport Efficiency Index (WTEI) and projected inventory turnover demonstrate measurable improvements in performance, reflecting enhanced delivery reliability and inventory accuracy. Forecasting methods such as the moving average model prove more suitable for short-term planning due to their accuracy and responsiveness. Additionally, the Quality Function Deployment (QFD) framework highlights customer-centric priorities—such as real-time tracking and user-friendly interfaces—as key drivers for future TMS development. By aligning technical functionalities with customer needs and operational metrics, organizations can establish more intelligent, adaptive, and competitive logistics ecosystems. Ultimately, the integrated application of TMS for warehouse management not only supports efficient logistics operations, but also lays the foundation for data-driven decision-making and long-term strategic value across the supply chain.

In conclusion, businesses that invest in joint TMS systems are enhancing daily operational efficiencies and maintaining long-term company stability. Empowered with reliable and instantaneous information, organizations can make smarter decisions, reduce costs, increase productivity, improve customer experiences and enable a competitive edge. This is of particular importance for competitive advantage. Establishing logistics that more intricate and interconnected, the need for advanced digital solutions will only grow as well. Companies that adopt digitalization supply chain by using Transport Management System in logistics will be better prepared to focus on the market and address future supply chain challenges to create long term sustainable competitive advantage in the market.

REFERENCES

Fiksel, J., Polyviou, M., Croxton, K. L., & Pettit, T. J. (2015). From risk to resilience: Learning to deal with disruption. MIT Sloan Management Review, 56(2), 79–86.

Walker, B., Holling, C. S., Carpenter, S. R., & Kinzig, A. (2002). Resilience, adaptability and transformability in social–ecological systems. Ecology and Society, 9(2), 5. https://doi.org/10.5751/ES-00650-090205

Barnett, C. K., & Pratt, M. G. (2000). From threat-rigidity to flexibility: Toward a learning model of autogenic crisis in organizations. Journal of Organizational Change Management, 13(1), 74–88. https://doi.org/10.1108/09534810010310205

Callister, W. D., & Rethwisch, D. G. (2003). Materials science and engineering: An introduction (7th ed.). John Wiley & Sons.

Hamel, G., & Välikangas, L. (2003). The quest for resilience. Harvard Business Review, 81(9), 52–63.

Ponomarov, S. Y., & Holcomb, M. C. (2009). Understanding the concept of supply chain resilience. The International Journal of Logistics Management, 20(1), 124–143. https://doi.org/10.1108/09574090910954873

Sprague, L. G. (2007). Evolution of the field of operations management. Journal of Operations Management, 25(2), 219–238. https://doi.org/10.1016/j.jom.2006.04.002

Karmarkar, U. S., & Apte, U. M. (2007). Operations management in the information economy: Information products, processes and chains. Journal of Operations Management, 25(2), 438–453. https://doi.org/10.1016/j.jom.2006.11.002

Parmenter, D. (2015). Key performance indicators: Developing, implementing, and using winning KPIs (3rd ed.). Wiley.

Chopra, S., & Meindl, P. (2019). Supply chain management: Strategy, planning, and operation (7th ed.). Pearson.

Christopher, M., & Peck, H. (2004). Building the resilient supply chain. The International Journal of Logistics Management, 15(2), 1–14. https://doi.org/10.1108/09574090410700275

Hayes, R. H., & Wheelwright, S. C. (1984). Restoring Our Competitive Edge: Competing Through Manufacturing. New York: John Wiley & Sons.

Ballou, R. H. (2004). Business logistics/supply chain management: Planning, organizing, and controlling the supply chain (5th ed.). Pearson Education.

Rushton, A., Croucher, P., & Baker, P. (2017). The handbook of logistics and distribution management (6th ed.). Kogan Page.

Frazelle, E. (2002). Supply chain strategy: The logistics of supply chain management. McGraw-Hill.

Makridakis, S., Wheelwright, S. C., & Hyndman, R. J. (1998). Forecasting: Methods and applications (3rd ed.). Wiley.

Hyndman, R. J., & Athanasopoulos, G. (2021). Forecasting: Principles and practice (3rd ed.). OTexts. https://otexts.com/fpp3/

Stevenson, W. J. (2020). Operations management (14th ed.). McGraw-Hill Education.

Chase, C. W. (2013). Demand-driven forecasting: A structured approach to forecasting (2nd ed.). Wiley.

Akao, Y. (1990). Quality function deployment: Integrating customer requirements into product design. Productivity Press.

Hauser, J. R., & Clausing, D. (1988). The house of quality. Harvard Business Review, 66(3), 63–73.

Chan, L. K., & Wu, M. L. (2002). Quality function deployment: A literature review. European Journal of Operational Research, 143(3), 463–497. https://doi.org/10.1016/S0377-2217(01)00320-4

Zairi, M., & Youssef, M. A. (1995). Quality function deployment: A main pillar for successful total quality management and product development. International Journal of Quality & Reliability Management, 12(6), 9–23. https://doi.org/10.1108/02656719510089860