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Optimizing the Expansion and Engineering of X-XP Express's Logistics Facilities in West Java to Handle Surge in Shipping Volume During the "Twin Dates" and "Pay Day Sale" Periods

Elfa Firdy Gunawan[1*], Nur Aisyah[2], Harkaffi Wilmar[3], Estu Hafiz Pamungkas[4]
[1-4] Universitas Logistik dan Bisnis Internasional, Indonesia
email: firdygunawan2607@gmail.com[1]

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Abstract

The rapid growth of e-commerce has intensified operational challenges for logistics providers, particularly during double-date promotional campaigns and Pay Day Sale periods that generate substantial surges in shipment volume within a limited timeframe. This study investigates the operational performance of X-XP Express logistics facilities in West Java and evaluates strategies for optimizing facility capacity and workforce allocation under peak-demand conditions. An empirical quantitative case-study approach was employed using operational records, shipment-volume data, facility-capacity information, and manpower allocation data collected from Distribution Center operations in the Bandung–Cimahi region. The analytical framework integrates a Multi Channel–Single Phase (M/M/s) queueing model, logistics-network simulation using AnyLogistix, and discrete-event simulation using AnyLogic. The results indicate that the initial system operated at a utilization level of 0.94, with an average queue length of 10.95 packages and a waiting time of 26.28 seconds. Capacity expansion and manpower adjustments reduced utilization to 0.77, decreased queue length to 0.40 packages, and shortened waiting time to 0.24 seconds. Network simulation further demonstrated that a three-Distribution-Center configuration achieved full demand coverage within the modeled service radius. The study highlights the effectiveness of simulation-based logistics engineering in improving operational resilience, service performance, and capacity management during periods of extraordinary demand.

Keywords: *Optimization, Distribution Center, Discrete Event Simulation, Capacity Planning, E-Commerce Logistics.*

INTRODUCTION

The transformation of global commerce through digital platforms has fundamentally altered the strategic role of logistics systems, shifting them from a supporting operational function into a primary determinant of customer value creation, market responsiveness, and competitive advantage. The acceleration of e-commerce transactions across both developed and emerging economies has generated unprecedented fluctuations in demand patterns, particularly during concentrated promotional events that induce temporary but extreme surges in order volumes. Within this context, logistics organizations are increasingly challenged to maintain service continuity, operational resilience, and fulfillment reliability while simultaneously controlling costs and optimizing resource utilization. Contemporary supply chain scholarship has consequently emphasized the importance of digitally enabled logistics ecosystems capable of anticipating, simulating, and adapting to disruptions through data-driven decision-making frameworks. The emergence of digital supply chain twins and advanced simulation technologies reflects a broader transition toward predictive and adaptive logistics management, where organizational performance is increasingly dependent upon the capability to synchronize infrastructure capacity, workforce allocation, and network design under conditions of uncertainty and volatility (Ivanov & Dolgui, 2021). Such developments have become particularly relevant in rapidly growing e-commerce markets where demand spikes generated by promotional campaigns impose substantial pressure on distribution facilities and transportation networks.

Existing literature has demonstrated that logistics performance during peak-demand periods is strongly associated with customer satisfaction, operational efficiency, and organizational competitiveness. Empirical findings indicate that delivery timeliness and service quality constitute critical determinants of consumer evaluations in e-commerce environments, particularly during double-date promotional campaigns characterized by heightened customer expectations and compressed fulfillment windows (Fauziah et al., 2025). Research on transportation engineering and logistics distribution has similarly highlighted the necessity of integrating infrastructure planning with distribution strategies to reduce operational bottlenecks and enhance network responsiveness (Sonhaji et al., 2022). Complementary studies examining the economic consequences of logistics infrastructure development reveal that improvements in transportation accessibility and distribution capacity generate significant positive effects not only for logistics operators but also for broader economic ecosystems, including small and medium-sized enterprises that depend on efficient product flows (Rifky & Kurniati, 2026). Collectively, these studies suggest that logistics capability is increasingly recognized as a strategic resource whose effectiveness extends beyond operational performance and directly influences market competitiveness and regional economic productivity.

Despite these advances, the current body of knowledge remains fragmented in several important respects. A substantial proportion of logistics studies continues to focus on isolated operational components such as transportation routing, warehouse performance, delivery punctuality, or facility layout redesign without adequately examining the dynamic interactions among these elements within an integrated logistics system. Investigations into warehouse inefficiencies, for instance, have successfully identified root causes of operational defects through analytical tools such as Pareto analysis, Fishbone Diagrams, and Five-Why Analysis, yet their explanatory scope often remains limited to static diagnostic perspectives that do not capture the evolving effects of demand fluctuations on system-wide performance (Deokosta et al., 2026). Studies concerning logistics facility redesign have demonstrated the benefits of systematic layout planning for improving operational flow and space utilization, although these analyses are generally confined to internal facility optimization and rarely incorporate broader network-level considerations or demand surge scenarios characteristic of e-commerce peak seasons (Silitonga & Nicholas, 2026). Consequently, existing research has produced valuable operational insights while offering limited understanding of how facility expansion, capacity adjustment, manpower allocation, and distribution network configuration interact simultaneously under volatile demand conditions.

A further conceptual limitation emerges from the tendency of prior studies to evaluate logistics performance under relatively stable operating environments, whereas real-world e-commerce systems increasingly operate under conditions marked by abrupt demand escalation, temporal concentration of orders, and heightened service-level expectations. Evidence regarding delivery delays indicates that both internal organizational factors and external environmental variables contribute significantly to logistics disruptions, suggesting that operational performance cannot be adequately explained through single-factor analyses (Anniza, 2025). Research on workforce performance within logistics distribution units has likewise demonstrated that organizational and environmental conditions substantially influence employee productivity and operational outcomes, underscoring the importance of human-resource considerations in logistics capacity planning (Pratama, 2026). The coexistence of infrastructural constraints, workforce limitations, and fluctuating demand patterns exposes a critical empirical gap regarding the mechanisms through which logistics organizations can proactively reconfigure facilities and operational resources to maintain service reliability during extreme demand peaks. Current literature offers insufficient evidence concerning the effectiveness of integrated facility expansion and manpower engineering strategies in mitigating congestion, queue formation, and service degradation during promotional events such as double-date campaigns and Pay Day Sale periods.

The unresolved nature of this problem carries considerable scientific and managerial implications because the inability to align logistics capacity with rapidly fluctuating demand can trigger cascading disruptions throughout the supply chain, including processing delays, inventory congestion, transportation inefficiencies, and declining customer satisfaction. From a theoretical perspective, the challenge highlights the need to move beyond static analyses toward more dynamic representations of logistics systems that recognize the interdependence of infrastructure, operational processes, and human resources. From a practical perspective, logistics service providers require robust analytical frameworks capable of evaluating alternative capacity-expansion scenarios before substantial investments are committed, particularly in regions characterized by high transaction intensity and dense population concentrations. The growing adoption of simulation-based approaches in supply chain research provides a promising pathway for addressing this challenge because simulation environments enable organizations to experiment with alternative configurations, evaluate performance consequences, and support evidence-based decision making. The methodological significance of such approaches is reinforced by the importance of verification and validation procedures, which ensure that simulation outputs accurately represent the operational realities they are intended to model (Sargent, 2013). Despite these advantages, empirical applications integrating facility expansion, workforce engineering, queueing dynamics, and distribution network optimization within a unified analytical framework remain relatively scarce.

This study positions itself at the intersection of logistics facility optimization, capacity management, and simulation-based decision support by investigating how strategic expansion and operational engineering of Distribution Center facilities can enhance logistics performance during demand surges generated by double-date promotional events and Pay Day Sale campaigns. The research examines the logistics operations of X-XP Express in West Java through an integrated analytical framework that combines distribution network evaluation, capacity adjustment analysis, manpower optimization, and operational simulation. The study seeks to develop a comprehensive understanding of the relationships among facility capacity, workforce allocation, queue dynamics, and service performance under peak-demand conditions while generating empirically grounded recommendations for logistics managers. Its contribution lies in advancing a systemic perspective of logistics optimization that simultaneously addresses macro-level distribution structures and micro-level operational processes, while also demonstrating the value of combining analytical modeling and simulation techniques as complementary tools for strategic logistics planning in highly volatile e-commerce environments.

RESEARCH METHODS

This study adopts an empirical research design employing a quantitative case-study approach to examine the operational performance of X-XP Express logistics facilities in West Java during periods of extraordinary demand generated by double-date promotional events and Pay Day Sale campaigns. The unit of analysis comprises the Distribution Center (DC) operations that function as the critical processing node between First Mile and Last Mile activities. The population encompasses all package flows processed through the company's logistics network within the Bandung–Cimahi operational region, while the analytical sample consists of shipment-volume records, operational processing data, facility-capacity information, manpower allocation data, and service performance indicators collected from selected Distribution Centers representing the company's principal logistics infrastructure. Primary data were obtained through structured interviews and operational observations involving logistics personnel and facility supervisors, whereas secondary data were derived from internal company reports, historical Average Daily Order (ADO) records, and operational performance documentation. The principal variables include shipment arrival rate, service rate, facility capacity, manpower availability, queue length, waiting time, system utilization, and service-level performance. These variables were operationalized to capture the interaction between demand intensity and operational capacity, enabling the evaluation of alternative facility-expansion and workforce-engineering scenarios under both normal and peak-demand conditions.

The measurement framework integrates queueing theory, discrete-event simulation, and logistics network analysis to evaluate system performance across alternative operational configurations. Key performance indicators were quantified using the Multi Channel–Single Phase (M/M/s) queueing model, including system utilization (ρ), average queue length (L_q), average waiting time (W_q), and system idle probability (P_0). Analytical computations were conducted using POM-QM for Windows, while network-level optimization and demand-coverage assessments were performed through AnyLogistix. Operational-level simulations of Distribution Center activities, including unloading, sorting, storage, and dispatch processes, were developed using AnyLogic based on a discrete-event simulation framework. Data quality and model reliability were assessed through verification and validation procedures employing Mean Absolute Deviation (MAD), Mean Absolute Percentage Error (MAPE), and Root Mean Square Error (RMSE), ensuring that simulation outputs accurately reflected observed operational conditions. Stability assumptions for the queueing model were evaluated through the utilization criterion ($\rho < 1$), while comparative scenario analysis was employed to assess the effectiveness of capacity expansion and manpower adjustment strategies in reducing congestion, improving processing efficiency, and sustaining service-level performance during demand surges.

RESULTS AND DISCUSSION

Demand Surge Characteristics and Distribution Center Performance During Peak Promotional Periods

The empirical analysis revealed that shipment volume within the Bandung–Cimahi operational region increased substantially during double-date campaigns and Pay Day Sale events, producing a pronounced deviation from normal operational patterns. Historical Average Daily Order records indicated that the surge was not merely quantitative but also temporal, as package arrivals became concentrated within narrower processing windows. Queue formation emerged primarily during inbound receiving and sorting activities, where operational resources experienced sustained pressure for several consecutive hours. Similar patterns have been identified in peak-season logistics environments where demand concentration creates systemic congestion risks beyond ordinary operational variability (Taryadi & Larutama, 2025).

Arrival-rate observations demonstrated that the Distribution Center functioned near its maximum processing threshold during promotional periods. The calculated utilization coefficient reached 0.94 under the baseline scenario, indicating that available service capacity was only marginally greater than incoming demand. Queueing theory predicts that systems operating at utilization levels approaching unity become increasingly vulnerable to instability and exponential queue growth. This finding aligns with previous logistics studies emphasizing the sensitivity of fulfillment performance to small changes in demand intensity during peak seasons (Aisah Dinda Nurhalizah Mawardy & Indro Kirono, 2025).

Operational records further showed that congestion effects propagated across multiple process stages rather than remaining isolated within a single activity. Delays originating at unloading stations subsequently affected sorting efficiency, temporary storage availability, and outbound dispatch readiness. Interdependencies among logistics processes amplified the operational consequences of localized bottlenecks. Similar supply chain interactions have been discussed within integrated logistics frameworks that emphasize process synchronization as a determinant of system resilience (Indrasari & Komari, 2026).

Observed waiting times increased disproportionately relative to shipment growth, suggesting that the relationship between demand and processing performance was nonlinear. Such behavior is consistent with classical queueing dynamics where performance deterioration accelerates once utilization exceeds optimal operational thresholds. Processing delays also generated temporary package accumulation within transit storage areas. Empirical evidence from logistics delay studies similarly indicates that capacity constraints often manifest through escalating waiting times before becoming visible in service-level indicators (Anniza, 2025). The operational condition prior to capacity intervention is summarized in Table 1, which presents the principal queueing indicators derived from the M/M/s analytical model.

Table 1. Baseline Queueing Performance Indicators of the X-XP Express Distribution Center Prior to Capacity Adjustment

Indicator	Baseline Condition
Arrival Rate (λ)	1,500 packages
Number of Servers (s)	16 operators
Utilization (ρ)	0.94
Average Queue Length (Lq)	10.95 packages
Average Waiting Time (Wq)	26.28 seconds
Probability of Idle System (P0)	Near 0

The values presented in Table 1 indicate that the facility remained technically stable while simultaneously operating under substantial operational strain. The extremely low idle probability confirms continuous resource engagement throughout the observed period. Service resources had limited flexibility to absorb unexpected fluctuations beyond forecasted demand levels. Such conditions are frequently associated with elevated operational risk in e-commerce logistics networks (Fauziah et al., 2025).

The queue-length indicator deserves particular attention because it reflects accumulated inefficiencies across upstream and downstream activities. An average queue exceeding ten packages appears moderate in isolation, yet the cumulative effect across thousands of transactions can significantly disrupt workflow continuity. Warehouse operations become increasingly vulnerable when package accumulation restricts internal movement and handling efficiency. Comparable warehouse performance challenges have been reported in studies examining operational disruptions within logistics facilities (Deokosta et al., 2026).

Spatial analysis of facility operations revealed uneven workload distribution among processing zones. Sorting stations and temporary storage areas consistently exhibited higher occupancy rates than quality-control sections. Resource imbalance reduced overall system efficiency despite adequate performance in certain operational segments. Facility-layout research similarly highlights the importance of balancing workflow intensity across interconnected logistics processes (Silitonga & Nicholas, 2026).

Demand fluctuations also affected transportation coordination between Distribution Centers and delivery networks. Increased inbound volume required more frequent vehicle handling, while outbound scheduling became increasingly sensitive to processing delays. Transportation and warehousing functions therefore operated as mutually dependent performance drivers rather than independent operational units. Such findings support logistics management perspectives emphasizing the strategic integration of transportation and storage activities (Wihyawari et al., 2025).

Forecast comparisons demonstrated that promotional-event demand exceeded normal operational projections by a substantial margin. Existing forecasting assumptions proved adequate for regular periods but underestimated extreme seasonal surges. Forecasting accuracy becomes particularly important when capacity planning decisions depend on anticipated demand trajectories. Previous studies have similarly emphasized the importance of adaptive forecasting strategies for managing shipment-volume variability in logistics organizations (Sari et al., 2025).

The empirical findings collectively indicate that the primary challenge faced by X-XP Express was not the absence of operational resources but the mismatch between demand concentration and available processing capacity. Distribution Center performance remained functional under ordinary conditions but approached critical thresholds during promotional events. Queueing metrics provide quantitative evidence that the facility possessed limited resilience against sustained demand escalation. Contemporary supply chain resilience theory similarly argues that operational stability depends on maintaining adequate capacity buffers capable of absorbing disruption-induced variability within logistics systems (Ivanov & Dolgui, 2021).

Distribution Network Expansion and Capacity Optimization Through Simulation-Based Logistics Engineering

Simulation results generated through AnyLogistix demonstrated that demand growth during promotional periods altered the spatial distribution of logistics workloads across the West Java operational network. Increased shipment density was accompanied by longer distribution distances and higher transportation intensity, particularly in urban clusters with elevated e-commerce penetration. Existing infrastructure remained capable of serving demand under normal conditions, yet peak-season scenarios exposed limitations in facility load balancing and regional coverage efficiency. Similar observations have been reported in studies emphasizing the strategic role of logistics-network connectivity in sustaining operational competitiveness and distribution performance (Fatizhudin et al., 2025).

Network analysis revealed that the deployment of three Distribution Centers, namely GFA DC, DC Kopo, and DC Nanjung, created a more balanced allocation of processing responsibilities across the Bandung metropolitan area. Demand clusters that were previously concentrated within a single processing node became distributed among multiple facilities. This redistribution reduced the operational burden imposed on individual centers and enhanced overall network flexibility. Transportation-engineering research has consistently emphasized that decentralized logistics configurations improve responsiveness under fluctuating demand conditions (Sonhaji et al., 2022).

The demand-coverage simulation further indicated that all customer demand points could be reached within the modeled service radius of 100 kilometers. Geographic accessibility improved because shipment flows were redirected toward facilities positioned closer to demand concentrations. Reduced travel distance contributed not only to delivery efficiency but also to greater operational predictability. Previous studies examining logistics infrastructure expansion have similarly associated broader network accessibility with improved service outcomes and regional economic performance (Rifky & Kurniati, 2026).

A notable finding emerged from the comparison between centralized and distributed operational scenarios. Centralized processing generated higher resource utilization but also exposed the system to elevated disruption risks when demand exceeded expected levels. Distributed processing created additional operational redundancy, allowing demand surges to be absorbed across multiple facilities. This outcome reflects resilience-oriented logistics strategies that prioritize adaptability alongside efficiency objectives (Ivanov & Dolgui, 2021). The principal network simulation outputs are summarized in Table 2, illustrating the operational implications of the three-Distribution-Center configuration.

Table 2. Distribution Network Performance and Demand Coverage Results under the Three-Distribution-Center Configuration

Network Performance Indicator	Simulation Result
Number of Distribution Centers	3
Demand Coverage	100%
Maximum Service Radius	100 km
Main Coverage of DC Kopo	24 km
Main Coverage of GFA DC	15 km
Service Categories Supported	6 services

The information presented in Table 2 indicates that network expansion produced measurable improvements in spatial demand coverage and service accessibility. The availability of multiple facilities reduced the concentration of logistics activities within a single operational node. Coverage effectiveness became particularly important during demand spikes when shipment volumes increased simultaneously across multiple regions. Logistics-network studies have consistently highlighted facility positioning as a critical determinant of service reliability and operational scalability (Suhada et al., 2024).

Service diversification emerged as another important outcome of the network optimization process. The simulation incorporated multiple service categories, including Regular, Next Day, Cargo Economy, Same Day, Instant, and Instant Priority deliveries. Different service classes generated distinct operational requirements and resource consumption patterns. Customer satisfaction research has repeatedly shown that delivery speed and service differentiation significantly influence consumer perceptions in e-commerce environments (Eviyanti et al., 2025).

Cost-efficiency considerations also became evident during network evaluation. Although the establishment or utilization of additional facilities may increase fixed operational expenditures, the resulting reduction in congestion and processing delays can offset those costs through improved service performance. Network optimization therefore involves balancing cost minimization against responsiveness and resilience objectives. Similar trade-offs have been documented in studies examining logistics pricing structures and operational resource allocation within distribution systems (Arsenata & Ridhawati, 2025).

The simulation results further suggested that facility expansion should not be interpreted exclusively as a physical infrastructure strategy. Organizational decision-makers benefited equally from improved visibility regarding shipment flows, demand distribution, and resource deployment. Digital simulation environments enabled the evaluation of multiple operational scenarios before actual implementation. Such analytical capabilities are increasingly recognized as essential components of modern logistics management and digital supply-chain transformation (Widodo et al., 2025).

Facility placement also influenced inventory movement efficiency within the broader logistics ecosystem. Shorter transportation routes reduced handling frequency and minimized the probability of package accumulation within intermediate processing stages. Operational stability consequently improved even before additional manpower interventions were introduced. Similar relationships between infrastructure design and logistics efficiency have been observed in studies investigating transportation–warehousing integration within complex distribution networks (Wihyawari et al., 2025).

The findings collectively indicate that network expansion represents a strategic mechanism for enhancing logistics resilience during demand surges. Performance improvements were generated not merely through increased capacity but through the spatial redistribution of operational workloads across interconnected facilities. Simulation evidence demonstrates that facility engineering decisions possess significant implications for service coverage, transportation efficiency, and operational adaptability. Contemporary logistics-management theory increasingly supports the view that resilient distribution networks emerge from coordinated investments in infrastructure, connectivity, and data-driven planning capabilities rather than from capacity expansion alone (Fatizhudin et al., 2025).

Workforce Engineering and Operational Performance Improvement in Distribution Center Operations

The operational simulation conducted through AnyLogic demonstrated that manpower allocation constituted one of the most influential determinants of Distribution Center performance during peak-demand periods. Resource utilization patterns revealed that sorting operators, loaders, and material-handling personnel experienced significantly higher workloads than other operational units. Capacity limitations were therefore not solely associated with facility infrastructure but also with the availability and deployment of human resources. Studies examining logistics workforce performance similarly emphasize that employee capacity remains a critical factor in maintaining operational continuity under fluctuating demand conditions (Pratama, 2026).

Comparative simulation results showed that the addition of manpower produced a substantial reduction in system congestion. The utilization coefficient decreased from 0.94 to 0.77 following capacity adjustments and workforce expansion. This reduction created additional operational flexibility and prevented the system from approaching instability thresholds during peak periods. Queueing theory suggests that even moderate reductions in utilization can generate disproportionately large improvements in service performance when systems initially operate near saturation conditions.

The most significant improvement appeared in queue-related indicators. Average queue length declined from 10.95 packages to only 0.40 packages after the intervention scenario was implemented. Waiting time experienced an even greater proportional reduction, falling from 26.28 seconds to 0.24 seconds. Such performance gains indicate that workforce engineering addressed a fundamental bottleneck within the operational process rather than merely alleviating superficial symptoms of congestion.

Simulation outputs further revealed that operational benefits extended across multiple process stages. Increased manpower availability accelerated package transfer between unloading, sorting, and dispatch areas. Resource synchronization reduced idle time within downstream activities and improved overall workflow continuity. Similar findings have been reported in studies examining warehouse and fulfillment optimization under demand-intensive operating environments (Simanjuntak et al., 2026). The comparative performance indicators before and after workforce adjustment are presented in Table 3.

Table 3. Comparative Operational Performance of the Distribution Center Before and After Capacity and Workforce Optimization

Performance Indicator	Before Adjustment	After Adjustment
Utilization (ρ)	0.94	0.77
Average Queue Length (Lq)	10.95 packages	0.40 packages
Average Waiting Time (Wq)	26.28 seconds	0.24 seconds
Service Capacity	Baseline	Expanded

Performance Indicator	Before Adjustment	After Adjustment
Operational Flexibility	Limited	Improved

The values reported in Table 3 indicate that manpower intervention generated improvements across all key operational indicators. Queue reduction exceeding ninety percent suggests that labor resources represented a dominant constraint within the original system configuration. Performance enhancement was therefore achieved through a combination of increased service capacity and more balanced workload distribution. Workforce management literature frequently identifies labor allocation as one of the most cost-effective mechanisms for improving logistics performance during temporary demand surges (Pratama, 2026).

Resource-utilization analysis identified forklifts and loading personnel as the most intensively used assets within the Distribution Center. Their operational importance stemmed from their role in connecting inbound and outbound processes through material movement activities. Delays occurring within these functions produced cascading effects throughout the logistics chain. Similar operational dependencies have been observed in warehouse studies where handling resources function as critical links between sequential processing stages (Deokosta et al., 2026).

The simulation also highlighted the strategic value of proactive workforce planning. Peak-season demand is typically predictable in terms of timing, even when exact shipment volumes remain uncertain. Organizations capable of adjusting staffing levels before demand escalation occurs are more likely to maintain service-level performance throughout promotional campaigns. Evidence from logistics delay studies consistently demonstrates that inadequate labor preparation contributes significantly to operational disruptions during high-demand periods (Anniza, 2025).

Verification and validation procedures confirmed that the simulation outputs reflected observed operational conditions with acceptable accuracy. Performance indicators generated by the model remained consistent with historical operational records and managerial observations. Reliability assessment strengthened confidence in the analytical conclusions derived from the simulation scenarios. Methodological scholarship emphasizes that validated simulation models provide a robust foundation for operational decision-making and policy evaluation within complex systems (Sargent, 2013).

Workforce engineering also generated indirect benefits related to customer experience and service quality. Reduced waiting times accelerated package processing and improved delivery punctuality, both of which represent critical determinants of customer satisfaction in e-commerce logistics. Service reliability becomes particularly important during promotional campaigns when customer expectations regarding delivery speed tend to increase substantially. Empirical studies consistently identify timeliness as a major predictor of customer satisfaction and perceived logistics quality within digital commerce ecosystems (Fauziah et al., 2025).

The empirical evidence indicates that manpower optimization should be regarded as a strategic component of logistics-capacity planning rather than a short-term operational adjustment. Performance improvements emerged because workforce expansion was integrated with broader facility and process-engineering initiatives supported by simulation-based analysis. Operational resilience was strengthened through the creation of additional processing capacity capable of absorbing demand volatility without compromising service standards. These findings reinforce the argument that effective logistics management during peak-demand periods depends on the coordinated alignment of infrastructure resources, workforce capabilities, and data-driven planning mechanisms within an integrated operational framework (Ivanov & Dolgui, 2021).

CONCLUSION

The findings demonstrate that demand surges generated by double-date promotional events and Pay Day Sale campaigns significantly increase operational pressure on logistics systems, particularly within Distribution Center operations where capacity constraints, queue accumulation, and processing delays emerge as critical performance challenges. Empirical analysis confirmed that the baseline operational configuration of X-XP Express operated near its service-capacity threshold, making the system highly vulnerable to congestion during peak-demand periods. Network simulation results revealed that the strategic deployment of three Distribution Centers improved demand coverage, distributed workloads more evenly, and enhanced operational resilience across the West Java logistics network. Operational simulation further established that manpower engineering and capacity adjustments substantially reduced system utilization, queue length, and waiting time while improving workflow continuity and service responsiveness. The integration of queueing analysis, logistics-network simulation, and discrete-event simulation provides robust evidence that facility expansion and workforce optimization function most effectively when implemented as complementary strategies rather than isolated interventions. These results reinforce the importance of data-driven capacity planning, simulation-based decision support, and adaptive resource allocation in sustaining logistics performance and service reliability within highly dynamic e-commerce environments.

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