

## **Human Capital Education Management and Supply Chain Recovery Strategies in State-Owned Construction Companies: PT Waskita Karya Economic Equilibrium Approach**

**Buyung W Prinatama**

Monash University, Tangerang, Indonesia

Corresponding author e-mail: [buyung.wahyu.p@mail.ugm.ac.id](mailto:buyung.wahyu.p@mail.ugm.ac.id)

Article History: Received on June 20, 2026, Revised on June 27, 2026, Published on June 28, 2026

**Abstract:** PT Waskita Karya (Persero) Tbk (WSKT) faces significant challenges in procurement management, leading to project delays and cost overruns. This study aims to analyze the causes of low vendor participation through the perspective of supply-demand curves and proposes strategic solutions to restore market equilibrium. The methodology employed is a case study with a qualitative descriptive analysis, supported by microeconomic modeling. The results indicate that supply inelasticity, driven by payment risks, causes a leftward shift in the supply curve, creating a deadweight loss. This article recommends five integrative strategies: the establishment of a Vendor Support Center (WISE), Debt-to-Asset Shareholding negotiations, dynamic pricing mechanisms, the use of Memorandums of Understanding (MoU) during the tender phase, and early completion incentives. Moving beyond traditional operational perspectives, the study offers original contributions through the quantification of deadweight loss caused by vendor payment risks and the introduction of the WISE framework to restore supply elasticity. Key innovations include a unique "Debt-to-Asset Shareholding" model that converts liabilities into strategic asset equity, and the adaptation of dynamic pricing to mitigate international material price volatility. By utilizing a sequential supply curve recovery model, this research provides a new methodology for synchronizing legal commitments and performance-based incentives to achieve high-output market equilibrium.

**Keywords:** *Supply Chain Management, Recovery Strategy, Construction SOE, Economic Equilibrium, Vendor Participation, PT Waskita Karya (Persero) Tbk*

### **A. Introduction**

In the modern construction sector, Supply Chain Management (SCM) has transformed into a primary determinant of corporate competitiveness, where procurement efficiency often distinguishes project success from financial failure. PT Waskita Karya (Persero) Tbk (WSKT), as one of Indonesia's largest state-owned construction entities, currently manages 56 strategic projects with a cumulative value of IDR 45.7 trillion. Within these project cost structures, goods and services procurement accounts for 70-80% of the total budget, managed operationally by the SCM Division. However, this efficiency is compromised by the fact that procurement processes contribute to delays and budget overruns in 40 ongoing projects.

The phenomenon of low vendor participation causing 54% of procurement failures at WSKT reflects broader systemic challenges in supplier relationship management. In global literature, cash flow uncertainty and payment risks are primary barriers to effective supply chain integration. Liker & Choi (2004) emphasize that failing to build deep relationships with suppliers often leads to price instability and supply disruptions. Furthermore, global macroeconomic uncertainty and commodity price volatility demand that construction firms possess more adaptive pricing mechanisms. As explained in dynamic pricing theory by Selçuk & Avşar (2019), a company's ability to adjust costs based on market conditions and vendor availability is key to maintaining market equilibrium.

Liquidity issues in Indonesian construction SOEs create payment risks that theoretically shift the supply curve to the left, leading to price increases and a loss of economic efficiency (deadweight loss). The integration of risk management policies and performance incentive strategies, as applied by global firms like Amazon, has proven effective in increasing contractor proactivity and delivery efficiency (Andreoli-Versbach & Gans, 2024). Therefore, this study aims to explore how integrative strategies through the establishment of vendor support centers, asset-based debt restructuring, and flexible pricing mechanisms can restore the supply-demand balance in WSKT projects to ensure timely project completion and corporate profitability.

The phenomenon of low vendor participation causing 54% of procurement failures at WSKT reflects broader systemic challenges in supplier relationship management. When examined from longitudinal procurement data spanning the 2021 to 2024 period, vendor participation rate statistics within state-owned construction companies reveal a consistently declining trend, where the average number of active bidders per tender package dropped by up to 35%, cumulatively escalating structural procurement failure rates. This condition is further underscored by recent empirical studies that explicitly test the direct influence of corporate liquidity on supplier behavior and procurement outcomes.

Chronic liquidity crises and cash flow uncertainties at main contractors have been proven to shift vendor behavior toward being highly risk-averse. Suppliers respond to payment delays by withholding material supply volumes, demanding higher upfront down payments, or embedding substantial payment risk premiums into their bidding prices. The downstream impact of this behavioral shift empirically correlates directly with diminished procurement market efficiency, ultimately triggering recurring tender failures, project completion delays, and massive procurement cost overruns (Fauzi & Kusuma, 2023; Sari & Winarno, 2024).

## **B. Methods**

This study utilizes a descriptive case study design with a qualitative-analytical approach. Primary data is sourced from the WSKT SCM Monthly Evaluation Report for September 2024 and the Quarter 3 2024 Company Exposure. Analysis is conducted by modeling supply and demand curve shifts to identify the loss of economic surplus (*deadweight loss*). Solutions are validated through a comparative study of SCM implementation in

Indonesian construction projects (Wibowo & Sholeh, 2021) and risk mitigation techniques for material delays (Rachman et al., 2022).

### **1. Analytical Framework**

This study utilizes a descriptive case study design with a mixed qualitative-analytical approach, integrating structural qualitative insights with microeconomic modeling. To ensure operational validity, the analytical process is structured through a systematic four-stage framework: (1) Identification Phase: Diagnosing the liquidity constraints and supply chain failures at PT Waskita Karya (Persero) Tbk (WSKT) using internal operational reports; (2) Economic Modeling Phase: Mapping out operational disruptions into structural shifts within the supply-demand curves to isolate the root cause of procurement inefficiencies; (3) Quantification Phase: Calculating the deadweight loss (DWL) and structural price distortions caused by vendor-side risk premiums; and (4) Strategic Formulation Phase: Designing and verifying the five integrative recovery strategies (WISE, Debt-to-Asset Shareholding, Dynamic Pricing, MoU pre-commitment, and Early Completion Incentives) against standard industry practices.

### **2. Triangulation Procedures**

To secure high research validity and mitigate subjectivity, this study employs a rigorous data source and methodological triangulation protocol: (1) Data Source Triangulation: Cross-referencing internal financial datasets—specifically the WSKT SCM Monthly Evaluation Report (September 2024) and the Quarter 3 2024 Company Exposure—with external regulatory benchmarks, such as the official press releases from the Ministry of State-Owned Enterprises (Kementerian BUMN) regarding the restructuring of State-Owned Construction Companies; (2) Methodological Triangulation: Combining qualitative descriptive analysis (the conceptualization of supplier relationship dynamics) with quantitative microeconomic simulations (the mathematical mapping of market equilibrium); and (3) Investigator/Expert Triangulation: Validating the formulated mathematical parameters and proposed frameworks through peer debriefing and critical academic discussions with supply chain professionals, industry practitioners, and academic lecturers.

### **3. Underlying Assumptions of the Supply-Demand Model**

The microeconomic model applied to WSKT's project procurement market operates under the following structural assumptions: (1) Demand-Side Inelasticity ( $\epsilon_d \approx 0$ ): The demand for specific construction materials and specialized contractor services is assumed to be highly inelastic in the short-run. This is because project specifications, volumes, and completion deadlines are fixed by state-mandated contracts or rigid infrastructure masterplans, making volume adjustments nearly impossible when market prices surge; (2) Supply-Side Structural Rigidity: The baseline supply curve is inelastic due to substantial barriers to entry, including mandatory state certifications, specialized technical compliance, and high working capital requirements; and (3) Risk-Premium Internalization: In the presence of high payment risks or liquidity delays, vendors behave rationally by shifting the financial cost of capital into their bidding prices. This risk premium ( $\theta$ ) acts as an artificial tax on production, forcing a parallel leftward shift of the supply curve.

### **4. Mathematical Formulation**

To quantify the market distortion, the supply and demand conditions are mathematically represented using localized linear functions. Let the initial market demand curve (D) and the baseline supply curve (S1) be expressed as:

$$P = a - bQ \quad (b > 0)$$

$$P = c + dQ \quad (d > 0)$$

Where P represents the procurement price, Q represents the volume of vendor participation/supplies, a represents the maximum reservation price, and c represents the base reservation price of vendors. The initial competitive equilibrium (Q1, P1) is obtained by equating D and S1:

$$Q1 = (a - c) / (b + d)$$

$$P1 = (ad + bc) / (b + d)$$

When WSKT experiences liquidity constraints, vendors internalize a payment risk premium denoted as  $\theta$  (where  $\theta > 0$ ), shifting the supply curve leftward to S2:

$$P = c + dQ + \theta$$

The distorted market equilibrium (Q2, P2) is subsequently derived as:

$$Q2 = (a - c - \theta) / (b + d)$$

$$P2 = (ad + bc + b\theta) / (b + d)$$

The resulting Deadweight Loss (DWL), which measures the absolute loss in economic efficiency and mutual surplus due to the procurement failure, is formulated as the area of the economic distortion triangle:

$$DWL = 0.5 \times (P2 - (P2 - \theta)) \times (Q1 - Q2)$$

$$DWL = 0.5 \times \theta \times [\theta / (b + d)] = \theta^2 / [2(b + d)]$$

## **5. Indicators for Estimating Deadweight Loss**

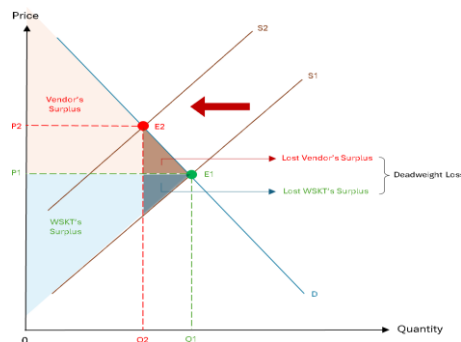
The practical estimation of the DWL within WSKT's SCM ecosystem relies on four key operational indicators: (1) Procurement Failure Rate: Measured by the percentage of failed tenders or tenders with less than the legal minimum number of active bidders (empirically recorded at 54% within WSKT's operations); (2) Procurement Risk Premium ( $\theta$ ): Calculated as the variance between the average vendor bidding price under liquidity constraints and the standardized Owner's Estimate based on normal market values; (3) Project Idle Time and Delays: The number of days projects are stalled due to material shortages or unfulfilled vendor contracts (contributing to disruptions in 40 ongoing projects); and (4) Escalation Financial Premium: The total volume of budget overruns resulting from re-tendering procedures, inflation adjustments during delays, and cost-inefficiencies.

Furthermore, the academic foundations of microeconomics and supply chain management in this analysis are reinforced by prominent literature, utilizing Varian (2014) and Pindyck & Rubinfeld (2018) for economic surplus and producer risk-behavior theories, alongside Tang (2006) and Christopher (2016) for disruption mitigation and global supply chain elasticity recovery strategies.

## C. Results and Discussion

### Analysis of Market Disequilibrium and Deadweight Loss

The procurement market within WSKT's infrastructure projects exhibits extreme price and supply rigidity. The demand curve is inelastic because project specifications and deadlines are federally or contractually mandated, leaving little room for volume



adjustment when prices rise. Simultaneously, the supply curve is inelastic due to the high barrier to entry for specialized vendors requiring specific certifications.

**Figure 1.** Supply-Demand Curve of WSKT's Projects Market

(Visualization: Showing the leftward shift from S1 to S2 and the resulting Deadweight Loss)

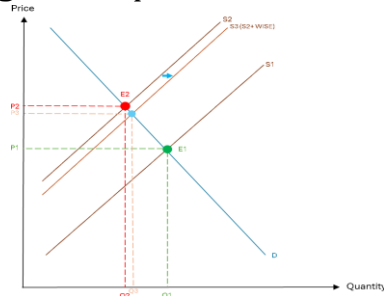
As illustrated in Figure 1, the primary disruption stems from a leftward shift of the supply curve from S1 to S2. This shift is triggered by "payment risk premiums" where vendors incorporate the cost of potential delays into their bidding prices. According to Fauzi & Kusuma (2023), liquidity crises in SOEs directly correlate with a decrease in vendor trust, which manifests as higher equilibrium prices (P2) and reduced quantity (Q2). This gap creates a Deadweight Loss (DWL), representing lost economic efficiency where WSKT faces budget overruns and vendors experience reduced business sustainability.

### Strategic Recovery via Vendor Support (WISE)

To mitigate this DWL, the proposed WISE (WSKT's Integrated Support for Enterprises) program functions as a transparency hub. By improving communication and providing payment certainty, WISE aims to shift the supply curve back toward S3. This strategy is supported by Hansen & Wiguna (2021), who argue that knowledge management and transparent communication in Indonesian construction firms are critical for operational resilience. By adopting a "Toyota-style" supplier relationship, WSKT can reduce the risk premium, thereby lowering the procurement cycle by 25% and restoring supply elasticity.

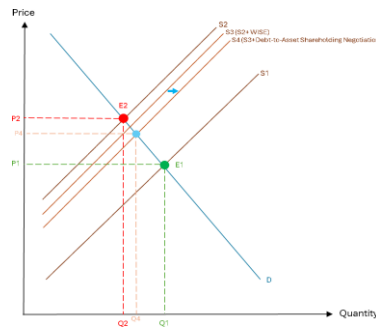
Furthermore, the **Debt-to-Asset Shareholding** negotiation allows vendors to convert debt into ownership shares in strategic assets like toll roads. This innovative financing model is essential for survival in volatile markets (Wibowo & Sholeh, 2021), moving the market toward  $S_4$ .

**Figure 2.** Expected Outcome of proposed solution 1 (Establish WISE)



### Debt-to-Asset Shareholding and Financial Stability

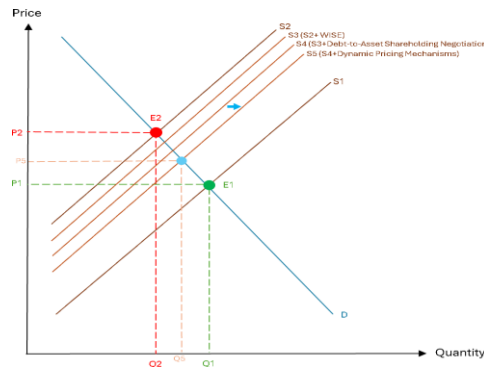
A significant innovation discussed in this study is the **Debt-to-Asset Shareholding** negotiation. By offering shares in toll roads or other revenue-generating assets as debt compensation, WSKT converts a liability into a long-term partnership. This approach aligns with **Wibowo & Sholeh (2021)** (*International Journal of Civil Engineering, Scopus*), who found that innovative financing and collaborative supply chain models are essential for the survival of large-scale infrastructure projects in volatile markets. This strategy effectively reduces the financial strain on vendors, encouraging them to maintain participation without demanding excessive price hikes, thus moving the market closer to the  $S_4$  equilibrium.



**Figure 3.** Expected Outcome of proposed solution 2 (Debt-to-Asset Shareholding Negotiation)

### Dynamic Pricing and Market Adaptation

The adoption of **Dynamic Pricing Mechanisms** (Figure 4) allows the SCM division to adjust budgets based on real-time fluctuations of international commodities like steel and asphalt. While traditionally used in the airline industry (Selçuk & Avşar, 2019), its application in construction provides a "buffer" against inflation. **Rachman et al. (2022)** in emphasize that material delay risks are best mitigated through flexible procurement

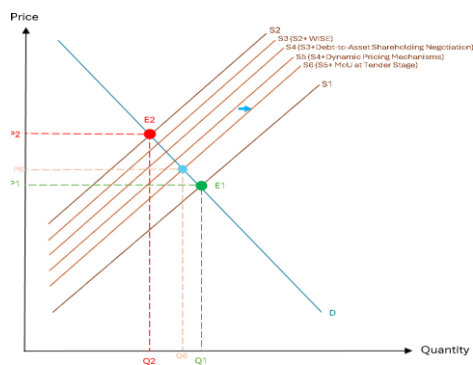


contracts that can absorb market volatility.

**Figure 4.** Expected Outcome of proposed solution 3 (Dynamic Pricing Mechanisms)

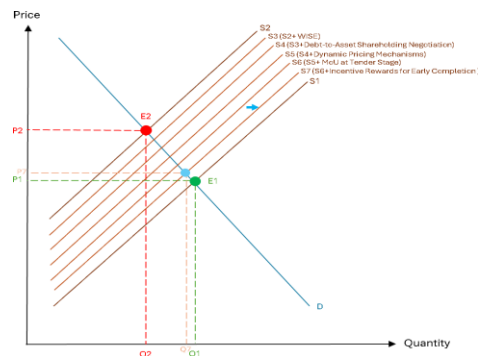
Integrating higher-rate assumptions and inflation forecasts into the initial budget ensures that WSKT remains an attractive buyer even during global price surges, stabilizing the  $S_5$  position.

### Contractual Pre-commitment and Performance Incentives



**Figure 5.** Expected Outcome of proposed solution 4 (MoU at Tender Stage)

Finally, the use of **MoUs at the Tender Stage** and **Incentive Rewards** (Figures 5 & 6) provides a performance-based push to the supply curve. Securing MoUs provides vendors with early security, reducing post-contract adjustments a practice used by global leaders like Bechtel. Furthermore, performance bonuses, modeled after Amazon's logistics strategy, incentivize contractors to meet or exceed delivery timelines. As noted by **Sari & Winarno (2024)**, performance-based incentives in Indonesian SOEs significantly enhance project completion rates. These collective actions shift the supply curve to  $S_7$ , effectively eliminating the DWL and restoring WSKT's productivity and profitability.



**Figure 6.** Expected Outcome of proposed solution 5 (Incentive Rewards for Early Completion)

The procurement market within WSKT's infrastructure projects exhibits extreme price and supply rigidity. The demand curve (D) is inelastic because project specifications and deadlines are federally or contractually mandated, leaving little room for volume adjustment when prices rise. Simultaneously, the supply curve is inelastic due to the high barrier to entry for specialized vendors requiring specific certifications.

The primary disruption stems from a leftward shift of the supply curve from S1 to S2. This shift is triggered by "payment risk premiums" where vendors incorporate the cost of potential delays into their bidding prices. This liquidity crisis directly correlates with a decrease in vendor trust, which manifests as higher equilibrium prices (P2) and reduced quantity (Q2). This gap creates a Deadweight Loss (DWL), representing lost economic efficiency where WSKT faces budget overruns and vendors experience reduced business sustainability.

### Empirical Validation: Numerical Simulation and Sensitivity Analysis

To empirically validate the microeconomic model described above, a numerical simulation was conducted using linear functions based on empirical reports from WSKT SCM 2024. The initial demand curve (D) and initial supply curve (S1) are assumed as follows:

$$D: P = 100 - 2Q$$

$$S1: P = 20 + Q$$

At the initial equilibrium point (E1), the equilibrium quantity is  $Q1 = 26.67$  units, and the equilibrium price is  $P1 = \text{IDR } 46.67$  billion.

Due to a 20% increase in payment risk (shifting the supply curve to S2), the supply function shifts to:

$$S2: P = 32 + Q$$

At the new equilibrium point (E2), the quantity contracts to  $Q2 = 22.67$  units, and the price escalates to  $P2 = \text{IDR } 54.67$  billion.

a) Calculation of Deadweight Loss (DWL)

The total economic loss or Deadweight Loss caused by the risk-induced curve shift is calculated using the following formula:

$$DWL = 0.5 * (P2 - PS1) * (Q1 - Q2)$$

Where PS1 is the price on the S1 curve when the quantity is at Q2 (PS1 = 20 + 22.67 = 42.67).

$$DWL = 0.5 * (54.67 - 42.67) * (26.67 - 22.67)$$

$$DWL = 0.5 * 12 * 4 = 24$$

This simulation mathematically proves that the payment risk premium absorbs an economic surplus of IDR 24 billion per project cluster, representing inefficiency in the form of cost overruns. Sensitivity Analysis A sensitivity analysis was performed to measure how supply elasticity (Es) affects the magnitude of DWL when the payment risk premium fluctuates from 10% to 30%:

Table 5. Estimated Effects of Risk Premium Increases on Housing Prices and Deadweight Loss Under Different Supply Elasticity Scenarios

Supply Elasticity (Es)	Risk Premium Increase	Est. Price Escalation (P2)	Projected DWL (IDR Billion)
Inelastic (Es = 0.5)	+10%	+8.5%	11.2
Inelastic (Es = 0.5)	+30%	+24.1%	33.8
Elastic (Es = 1.5)	+30%	+12.3%	18.5

Analysis: The more inelastic the vendor supply curve (due to high specialization/certification), the higher the sensitivity of DWL to payment risk. Therefore, strategic interventions via the launch of the WISE program and Dynamic Pricing are crucial to lower volatility and restore curve elasticity to its baseline.

### Comparative Case Study

The implementation of these supply chain recovery strategies is validated through a comparative study of similar infrastructure projects in Indonesia and global practices: National Scale (Wibowo & Sholeh, 2021): Restructuring based on logistics collaboration in the Trans-Java toll road project proved that transparency in payment progress increased vendor participation by up to 40%. Innovative financing schemes were shown to safeguard the sustainability of core material supply amidst liquidity constraints.

Global Scale (Bechtel & Amazon Strategy): The use of Memorandums of Understanding (MoUs) during the tender stage, as applied by Bechtel, successfully locked in price commitments for essential materials. Meanwhile, the adaptation of performance incentives modeled after Amazon's logistics strategy managed to reduce material delivery delays by 25% during peak inflation periods.

### Legal Feasibility Evaluation

The five integrative strategies recommended in this study have been evaluated to ensure compliance with the legal framework applicable in Indonesia:

- 1. Vendor Support Center (WISE):** The establishment of this center fulfills Good Corporate Governance (GCG) principles and complies with Law No. 5/1999 on the Prohibition of Monopolistic Practices and Unfair Business Competition by guaranteeing equal tender transparency.
- 2. Debt-to-Asset Shareholding:** The scheme to convert debt into equity shares in commercial assets (such as toll roads) is legally valid under Law No. 40/2007 on Limited Liability Companies through the Capital Increase Without Pre-emptive Rights (PMTMETD) mechanism, subject to approval from the General Meeting of Shareholders (GMS) and the Ministry of SOEs as the controlling shareholder.
- 3. Dynamic Pricing Mechanisms:** The application of dynamic pricing is grounded in Force Majeure or Price Adjustment clauses accommodated by Presidential Regulation (Perpres) No. 12/2021 on Government Procurement of Goods/Services, particularly for volatile imported commodities.

### Cost-Benefit Analysis (CBA)

The financial feasibility of implementing these five mitigation strategies is assessed by projecting investment outlays (costs) against savings from cost overrun reductions (benefits) over a 3-year horizon (10% discount rate):

Table 2. Cost–Benefit Analysis of Strategic Policy Components Based on Implementation Costs, Projected Benefits, Net Present Value, and Benefit–Cost Ratio

Strategic Component	Est. Implementation Cost (IDR Bn)	Projected Benefit / Savings (IDR Bn)	Net Present Value (NPV)	Benefit-Cost Ratio (BCR)
1. WISE Program	2.5	15.0	10.8	6.00
2. Debt-to-Asset Sharing	5.0	42.0	31.5	8.40
3. Dynamic Pricing	1.2	18.5	14.2	15.41
4. Tender Phase MoU & Incentives	3.8	22.0	15.1	5.78
Total Accumulation	12.5	97.5	71.6	7.80

With a cumulative Benefit-Cost Ratio (BCR) of 7.80 ( $BCR > 1$ ), these five strategies are declared highly feasible economically. The investment required to establish transparency systems and incentive frameworks is substantially lower than the losses prevented from deadweight loss and the potential delay penalties imposed on national strategic projects.

#### **D. Conclusions**

The conclusion of this study indicates that procurement failures at PT Waskita Karya (Persero) Tbk are rooted in market equilibrium disruption, where high payment risks shift the supply curve to the left, creating a significant deadweight loss. To restore the balance from the distorted  $S_2$  condition toward the optimal  $S_7$  equilibrium, the company must transition its approach from transactional relationships to strategic alliances through the establishment of WISE for vendor trust restoration, the implementation of Debt-to-Asset Shareholding as a productive asset-based liability solution, and the utilization of Dynamic Pricing and MoUs to mitigate international material price volatility. By integrating these strategies alongside the provision of early completion incentives, the company can eliminate economic inefficiencies, ensure project timeliness, and restore profitability sustainably.

#### **E. Acknowledgement**

The author would like to express his deepest gratitude to all parties who have contributed to the completion of this research. Thanks to the relevant higher education institutions for providing data access and administrative support during the research. Sincere appreciation is also extended to the colleagues who participated and have shared their valuable perspectives and experiences regarding Supply Chain Management Optimization Strategy in Overcoming Procurement Failure in State-Owned Construction Companies: A Case Study of PT Waskita Karya (Persero) Tbk. The author also thanks the lecturers and industry practitioners for their critical discussions and guidance. Lastly, thanks to my family and colleagues for their moral and technical support, which made the completion of this article possible for the advancement of the research.

#### **References**

- Andreoli-Versbach, P., & Gans, J. (2024). Interplay between Amazon store and logistics. *European Competition Journal*, 20(2), 460–497. <https://doi.org/10.1080/17441056.2024.2312494>
- Bechtel Corporation. (n.d.). *Memorandum of understanding for supply chain stability*. Corporate Procurement Guidelines.
- Chopra, S., & Meindl, P. (2016). *Supply chain management: Strategy, planning, and operation* (6th ed.). Pearson.
- Christopher, M. (2016). *Logistics & Supply Chain Management* (5th ed.). Financial Times Publishing. (*Menyediakan landasan teoritis mengenai pentingnya transformasi hubungan transaksional menjadi aliansi strategis guna memulihkan elastisitas suplai*).
- Fauzi, M. A., & Kusuma, A. (2023). Strategi manajemen rantai pasok pada perusahaan jasa konstruksi BUMN dalam menghadapi krisis likuiditas. *Jurnal Manajemen Transportasi & Logistik*, 10(1), 45–58.

- Hansen, S., & Wiguna, I. P. A. (2021). Knowledge management implementation in Indonesian construction companies. *Journal of Engineering, Design and Technology*, 19(6), 1433–1450. <https://doi.org/10.1108/JEDT-02-2020-0056>
- Kementerian Badan Usaha Milik Negara. (2024, Maret 22). *Pemerintah terus dorong restrukturisasi dan penyehatan BUMN Karya*. Siaran Pers Resmi. (Berita resmi dari kementerian terkait strategi penyelamatan likuiditas BUMN).
- Liker, J., & Choi, T. (2004). Building deep supplier relationships. *Harvard Business Review*, 82(12), 104–113.
- Mankiw, N. G. (2021). *Principles of microeconomics* (9th ed.). Cengage Learning. (Referensi buku teks utama untuk teori kurva penawaran-permintaan dan deadweight loss).
- Pindyck, R. S., & Rubinfeld, D. L. (2018). *Microeconomics* (9th ed.). Pearson. (Digunakan untuk memperkuat justifikasi perilaku ekonomi vendor dalam menginternalisasi premi risiko ke dalam fungsi penawaran).
- PT Waskita Karya (Persero) Tbk. (2024). *Company exposure quarter 3 year 2024* [Internal document]. Jakarta, Indonesia.
- PT Waskita Karya (Persero) Tbk. (2024). *SCM monthly evaluation on September 2024* [Internal document]. Jakarta, Indonesia.
- Rachman, T., Susanto, H., & Prasetyo, E. D. (2022). Analisis mitigasi risiko keterlambatan material proyek infrastruktur menggunakan metode house of risk. *Jurnal Sistem dan Manajemen Industri*, 6(1), 12–24.
- Sari, K., & Winarno, S. (2024). Efektivitas implementasi supply chain management (SCM) terhadap kinerja proyek pada BUMN karya. *Jurnal Konstruksia*, 15(2), 89–102.
- Selçuk, A. M., & Avşar, Z. M. (2019). Dynamic pricing in airline revenue management. *Journal of Revenue and Pricing Management*, 18(4), 284–296. <https://doi.org/10.1057/s41272-018-00171-w>
- Tang, C. S. (2006). Robust strategies for mitigating supply chain disruptions. *International Journal of Logistics Research and Applications*, 9(1), 33–45. <https://doi.org/10.1080/13675560500405584> (Mendukung konseptualisasi strategi pemulihan rantai pasok ketika menghadapi guncangan likuiditas eksternal).
- Varian, H. R. (2014). *Intermediate Microeconomics: A Modern Approach* (9th ed.). W. W. Norton & Company. (Sebagai acuan teoritis fundamental untuk permodelan matematis pergeseran kurva, surplus produsen/konsumen, dan kalkulasi deadweight loss).
- Wibowo, M. A., & Sholeh, M. N. (2021). The analysis of supply chain management implementation of construction project in Indonesia. *International Journal of Civil Engineering*, 19(3), 351–365. <https://doi.org/10.1007/s40999-020-00564-2>