Journal of Social Research
P-ISSN: 2827-9832
E-ISSN: 2828-335x
Vol.5, No.3, February 2026
http://ijsr.internationaljournallabs.com/index.php/ijsr

Case Study: Analysis of Work Breakdown Structure on Project Completion Time in the Procurement of Industrial Oleochemicals Items

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ABSTRACT

This research aims to analyze the application of project management in the areas of procurement knowledge (procurement) and logistics in the production facility construction project at PT X, an oleochemicals industry located in Indonesia. The problem to be solved arises from deviations in time and cost, particularly in the delivery schedule of items packaged in containers and shipped from international ports to Indonesia. These deviations result in cost overruns due to logistics delay fines. This study employs a descriptive quantitative approach using comparative analysis techniques. Primary data include project schedule documents, logistics reports, and actual cost data. The results of the analysis show that the greatest deviation occurred in the customs clearance phase and in the handling of container-to-factory transportation. The effect of schedule deviation on cost deviation is examined in this paper, and after analysis, it is concluded that there is a need to enhance the effectiveness of project change management in the procurement process to formally mitigate and integrate logistics schedule changes, thereby controlling the risk of cost overruns.

Keywords: *Project management, procurement, logistics, schedule deviation, cost deviation, oleochemicals industry.*

INTRODUCTION

The oleochemical industry is an industry that converts palm oil as a raw material into a more valuable derivative product through the process of Chemical Engineering. From a Chemical Engineering perspective, the success of an industry in running its process is determined not only by the design of the process and equipment but also by the timeliness of procuring the materials required for the process (Hytham, 2025). According to (Papageorgiou, 2009), supply chain optimization in the process industry is crucial due to the large and specific nature of equipment, where a delay in one critical component can halt the entire project commissioning schedule.

PT X faces complex logistical challenges in procuring goods X, which are large-quantity items imported to Indonesia using containers. The process of receiving these goods also requires strong coordination, especially because it involves two modes of transportation, namely sea and land. Uncertainties in the sea shipping process, such as bad weather and changes in ship schedules, often lead to the buildup of containers at the port. In addition, there are limitations in the local delivery fleet and storage management within the factory area. In the oleochemical industry, layout efficiency and storage management are vital aspects of asset management to prevent material damage caused by exposure to the corrosive port environment before the equipment is installed (Shamsuddin, 2016).

The accumulation of large quantities of containers simultaneously triggers significant operational issues, including fleet limitations, double handling during container shifting, disorganized schedules, and increased container rental costs when they are not returned on time. The resulting fees take the form of demurrage and detention fines. In terms of technical economics, this overflow of logistics costs directly worsens the economic feasibility parameters of the project (Peters et al., 2003).

Previous research has largely focused on production optimization; however, studies integrating project management with logistics risk mitigation in the oleochemical industry remain limited (Paul & Chowdhury, 2022). A project management approach emphasizing schedule and cost control is required to address the dynamic realities encountered in the field (Institute, 2021a, 2021b). (Behzadi et al., 2018) emphasized that supply chain resilience in the chemical industry requires a simulation model capable of anticipating logistics disruptions to ensure factory commissioning targets can be achieved without excessive operational costs.

Broadly, the project scope discussed in this paper includes the delivery of goods packaged in containers from abroad, the docking process of ships at Indonesian ports, container transportation using a prime mover fleet from the port to the factory, and the unloading of items from containers at PT X (Siswanto & Salim, 2019). For analysis, the discussion primarily focuses on project schedule management. The cost aspect, as a consequence of project management implementation, will be examined as a secondary impact in this study (Dubey et al., 2019).

This study aims to analyze the performance of project schedule management and its impact on demurrage and detention cost overruns within the procurement process, as well as to identify the correlation between schedule deviations and financial losses. Additionally, it examines the effectiveness of project management in managing information flows during critical situations and evaluates the role of stakeholders in mitigating cost impacts. As an output, this study formulates practical recommendations based on root-cause identification to improve time and cost management in PT X's procurement projects in the future.

METHOD

This research employs a descriptive quantitative approach. The data used are obtained from project documents such as shipping documents, customs documents, goods receipt data, and cost reports. The analysis is conducted using comparative techniques, namely by comparing the initial planning of the ideal schedule with the actual realization of the project item procurement process. The results of the comparison between time differences (scheduling aspect) and costs (the impact of deviations on the scheduling aspect) form the basis for assessing the magnitude of the deviation and are used to measure the level of effectiveness and efficiency of the purchasing process.

Specifically, the study focuses on the following items:

a. Baseline vs Actual schedule for the delivery and receipt of items, starting from the schedule of ship departure from the supplier to the schedule of returning the container to the port depo after the completion of the unloading process at PT X.
b. The duration of the dismantling of items at PT X.
c. Data on costs arising from schedule deviations from ships, such as late fines and other costs.

Data analysis will be carried out by comparing the ideal and actual schedules and calculating the difference in time and cost. The results of the analysis will be presented in the form of graphs, tables, and narrative interpretations. In addition, it will be known later whether the implementation of project management at PT X is sufficient or needs to be improved.

RESULTS AND DISCUSSION

The project to procure items packed in 158 containers from abroad for PT X requires strict coordination between stakeholders to ensure the arrival of goods on schedule and budget. This large volume complexity is managed through the division of Work Breakdown Structure (WBS) to map critical points, identify the roles of stakeholders (vendors, buyers, ship owners, clearance teams, and warehouses), and monitor progress in detail to avoid schedule conflicts.

The main sequence of activities in this project is: Bill of Lading (BL) Date → Tax document date → Container Receipt Date → Container Return Date.

The BL date is the initial marker when the ship departs, followed by the preparation of tax documents (Customs Notice) which must be prepared before the ship docks at the port of Indonesia as a condition for the removal of containers from the customs area. The container receipt date marks the arrival of the goods at the consumer's factory, while the container return date is the final marker indicating the item unloading process has been completed.

All stages have a sequential dependency (Finish-to-Start) without any overlap. This dependency simplifies scheduling but increases the risk of systemic delays if one of the stages is hampered, requiring close monitoring of each sequence of activities (Whitten & Bentley, 2007).

Based on the previous explanation, the WBS distribution for this project is as follows.

1. WBS 1: Shipping from Chinese port to Indonesian port

Shipping from the Chinese port to the destination port will ideally last for 20 days. This activity includes all loading processes at the port of origin, ship travel to docking ships at Indonesian ports. This duration is determined by the agreement between the buyer and the ship vendor.

2. WBS 2: Clearance Process by Customs at Indonesian ports

The Clearance process by Customs includes the creation of customs documents that can only be created after receiving a notification that the ship will dock so that consumers can prepare clearance documents. This activity includes document checks by customs and container release.

3. WBS 3: Delivery from Indonesian port to Factory

The Delivery Process from the port to the factory has an ideal duration of 1 day for containers in the same 1 BL because all of these containers arrive at the port and undergo the clearance process by customs in the same period of time.

4. WBS 4: Container Unloading Process in Factories

Delivery to container unloading at the factory has an ideal duration of 1 day where after the container is delivered, the unloading will be carried out on the same day so that the container can be returned on the same day to the port.

Almost all shipments experienced delays, with an average of 10.75 days, due to external factors during the critical period from the end to the beginning of the year. The main causes include congestion at major Chinese ports (Shanghai and Ningbo) exacerbated by the impact of the China–US trade war, the Chinese New Year holiday, and adverse weather conditions along shipping routes (Global, 2024; Ivanov, 2020; Linerlytica, 2025; Queiroz et al., 2020). The longest delay of 24 days occurred during the sixth shipment, which coincided with the Qingming Festival and the peak of shipbuilding activities in China in early April 2025. In contrast, two shipments were successfully completed on time due to favorable weather conditions, calm seas in the South China Sea, and the absence of operational obstacles at the ports of Ningbo, Shanghai, and Indonesia in late February and April 2025 (CNBC, 2025).

This variation in delays suggests that WBS 1 carries a high level of external risk. The inability of buyers to detect potential delays early indicates existing gaps in scheduling planning and control. Therefore, future planning must consider seasonal factors and national holidays in the country of origin, incorporate time buffers during high seasons, monitor vessels in real time, prepare alternative routes, and enhance active communication between shipping lines and buyers.

WBS 2 focuses on the document clearance process, with the ideal target of same-day completion (0 days). Based on observations, the majority of shipments (shipments 1, 2, 4, 5, and 7) were completed as scheduled. However, 37.5% of shipments experienced a one-day delay, namely shipments 3, 6, and 8. The primary causes of delays were technical glitches (downtime) in the electronic document submission system, as well as issues in document verification and uploading processes within the tax system. These constraints are categorized as external force majeure risks beyond company control. Given the extent of external influence from the tax system and the need for document accuracy, it is concluded that a baseline schedule of 0 days is too idealistic. It is recommended that future scheduling provide a buffer of 1–2 days as a risk mitigation measure.

WBS 3 covers the process from when the container is unloaded from the ship and transferred to the fleet for delivery to the factory. Delays in WBS 3 were dominated by 3–5-day delays, accounting for 72% of the total containers (107 units). The root causes include limitations in the prime mover fleet at the port and failures in resource and quality management, particularly related to preventive maintenance of port equipment (Mutadi, 2023). The absence of spare equipment and structured maintenance schedules led to complete operational halts in cases of equipment breakdown (Choi, 2021).

In addition to physical constraints, inefficiencies in coordination and non–real-time communication between fleet providers and ship owners further exacerbated delays. The lack of synchronization between fleet readiness and WBS 2 completion increased the risk of backlog costs at the port. Although these delays involve external parties, they reflect shortcomings in resource planning and risk mitigation. As a result, the duration of WBS 4 was pressured to be shortened, potentially increasing operational costs and the risk of demurrage fines.

WBS 4 involves unloading after containers arrive at the factory and returning the containers to the port depot. Ideally, each container can be unloaded within one day, as the process typically takes only 2–3 hours. WBS 4 is entirely under PT X's internal control, including receiving, unloading, and storing items in the warehouse. The data showed unstable performance, with 52% (78 containers) experiencing delays, indicating insufficient control over the unloading process.

The main causes of delays include inadequate reception area infrastructure—such as muddy pathways difficult to traverse during rain—and limited unloading areas, resulting in double handling and container repositioning. This issue is compounded by poor communication from transporters who fail to adhere to delivery schedules, leading to inefficient labor allocation. Delays in WBS 3 often cause containers to arrive simultaneously in large volumes, exceeding the capacity of the available unloading workforce.

The proposed solutions include improving road infrastructure, establishing clear fleets' entry and exit flow plans, and enhancing communication management. Real-time coordination between the purchasing and warehouse teams is essential to provide accurate arrival forecasts. In addition, written confirmation of area capacity before delivery, the use of outsourced labor to maintain schedules, and a reminder platform for transportation vendors are recommended to ensure delivery time adherence.

The cost analysis in this study serves as an indicator of the financial consequences of schedule deviations, focusing on two main penalty components: demurrage and detention. Demurrage is directly linked to delays in WBS 3 (port and prime mover fleet activities), while detention is associated with delays in WBS 4 (the internal unloading process at the factory).

In the demurrage component, extreme delays occurred during the seventh shipment, accounting for 52.6% of total port fines. This demonstrates that schedule deviations directly trigger penalty fees due to container accumulation at the port. PT X should allocate adequate contingency plans, such as third-party fleet arrangements, to mitigate these cost risks.

For the detention component, the seventh shipment again showed extreme deviation, contributing 66.5% of total late container return fines. This high cost reflects suboptimal coordination among stakeholders and operational bottlenecks, such as simultaneous fleet arrivals hindered by container shifting or double handling in the factory area.

The combined demurrage and detention costs reveal significant financial consequences for the project. This finding reinforces the hypothesis that improved project management planning is critical to minimizing delays in WBS phases 2, 3, and 4 to maintain project budget stability (Ervianto, 2023).

The project management performance evaluation at PT X highlights challenges in integrating PMBOK's critical knowledge areas, particularly in risk management, resource management, and communication. In terms of scheduling, the absence of sufficient buffers and effective contingency plans resulted in failures to anticipate external risks, such as electronic system disruptions in WBS 2 and port equipment breakdowns in WBS 3 (Golwakar, 2015). Moreover, insufficient human resource coordination and the lack of crisis communication protocols prolonged delay durations when unexpected schedule changes occurred.

Despite challenges in initial planning, the leadership of the Purchasing team became a key factor during crisis response. Facing significant potential penalties caused by external factors, the buyers proactively renegotiated with ship and port operators. By presenting factual data on internal document readiness and providing shipment forecasts, the team successfully secured fleet availability and established more effective communication channels (Dolgui & Ivanov, 2021).

The results of this adaptive leadership intervention had a substantial financial impact, as PT X obtained penalty fee dispensations, reducing fines to only about 30% of the initial liability. This case illustrates that leadership's ability to negotiate, manage stakeholder relationships, and maintain team focus under pressure is crucial for mitigating financial losses, even when formal planning structures encounter obstacles.

To prevent future schedule variances and cost overruns, this study recommends strengthening risk assessment and communication management processes. One key recommendation is implementing an integrated communication matrix that governs real-time information flow among all stakeholders. This communication strategy includes activating contingency plans immediately when customs system disruptions occur in WBS 2.

In the WBS 1 and WBS 3 phases, shipment status and equipment readiness should be monitored proactively at least two days before vessel arrival (H-2) via digital platforms such as instant messaging groups and task management tools. Internal coordination in WBS 3 should focus on physically validating storage area readiness and fleet line infrastructure to ensure prime movers can operate without technical hindrances in the field.

In addition to communication matrices, procurement effectiveness can be enhanced through the adoption of shipment tracking technology for transparency and the use of historical data to establish more realistic time buffers. Developing a collaborative culture supported by adaptive leadership will ensure that external disruptions are addressed promptly and appropriately, thereby minimizing systemic delay risks.

CONCLUSION

Based on the results of the analysis and discussion, this study concludes that the performance of project management in WBS 2, WBS 3, and WBS 4 shows limitations in adapting to changing field conditions and dynamic external risks. The schedule delays observed in these three phases confirm that less adaptive project management was the primary factor behind the failure to achieve baseline targets. Cost management analysis demonstrates a significant correlation between schedule deviations and cost overruns. Delays in the unloading process at the port (WBS 3) contributed to substantial demurrage penalty costs, while inefficiencies in the internal delivery and unloading processes at the factory (WBS 4) resulted in disproportionately high detention costs. Furthermore, the absence of adequate contingency plans in the clearance and port operation phases caused technical obstacles to escalate into actual financial losses. The lack of standby resource agreements with vendors was also a critical factor that prolonged container dwelling times. Overall, enhancing communication management effectiveness and strengthening risk mitigation strategies are essential to maintaining time and cost stability in future procurement projects.

REFERENCES

Behzadi, G., O'Sullivan, M. J., Olsen, T. L., & Zhang, A. (2018). Agribusiness supply chain risk management: A review of quantitative models. *Industrial Management & Data Systems*, *118*(3), 583–608. https://doi.org/10.1108/IMDS-03-2017-0112

Choi, T.-M. (2021). Innovative "bring-service-near-your-home" operations under corona-virus (COVID-19/SARS-CoV-2) outbreak. *Transportation Research Part E*, *136*, 101961. https://doi.org/10.1016/j.tre.2020.101961

CNBC. (2025). *Trade war fallout: China freight ship decline begins, demand plummets*. https://www.cnbc.com/2025/04/16/trade-war-fallout-china-freight-ship-decline-begins-orders-plummet.html

Dolgui, A., & Ivanov, D. (2021). Ripple effect and supply chain disruption management: New trends and research directions. *International Journal of Production Research*, *59*(1), 102–109. https://doi.org/10.1080/00207543.2020.1853828

Dubey, R., Gunasekaran, A., & Childe, S. J. (2019). Big data analytics capability in supply chain agility. *International Journal of Production Research*, *57*(7), 2092–2112.

https://doi.org/10.1080/00207543.2018.1540909

Ervianto, W. I. (2023). *Manajemen Proyek Konstruksi Edisi Terbaru*. CV Andi Offset.

Global, S. (2024). *Congestion rises at pelabuhans in China, Southeast Asia amid higher volumes, Red Sea crisis*.

Golwakar, K. (2015). *Process Equipment Procurement in the Chemical and Related Industries*. Springer.

Hytham, M. (2025). *What Are the Typical Activities Under the Procurement WBS?* https://www.planningengineer.net/what-are-the-typical-activities-under-the-procurement-wbs/

Institute, P. M. (2021a). *A Guide to the Project Management Body of Knowledge (PMBOK Guide)*. Project Management Institute.

Institute, P. M. (2021b). *A Guide to the Project Management Body of Knowledge (PMBOK Guide) and The Standard for Project Management – Seventh Edition*. PMI Publications.

Ivanov, D. (2020). Predicting the impacts of epidemic outbreaks on global supply chains: A simulation-based analysis on the coronavirus outbreak (COVID-19/SARS-CoV-2) case. *Transportation Research Part E, 136*, 101922. https://doi.org/10.1016/j.tre.2020.101922

Linerlytica. (2025). *Pelabuhan Congestion*. https://www.linerlytica.com/tag/pelabuhan-congestion/

Mutadi, A. N. (2023). *Manajemen Proyek*. Repository Universitas Negeri Malang.

Papageorgiou, L. G. (2009). Supply chain optimisation for the process industries: Advances and opportunities. *Computers & Chemical Engineering*, *33*(12), 1931–1938. https://doi.org/10.1016/j.compchemeng.2009.06.014

Paul, S. K., & Chowdhury, P. (2022). A production recovery plan in manufacturing supply chains for a high-demand item during COVID-19. *International Journal of Physical Distribution & Logistics Management*, *52*(2), 104–125. https://doi.org/10.1108/IJPDLM-04-2020-0127

Peters, M. S., Timmerhaus, K. D., & West, R. E. (2003). *Plant Design and Economics for Chemical Engineers*. McGraw-Hill Education.

Queiroz, M. M., Ivanov, D., Dolgui, A., & Fosso Wamba, S. (2020). Impacts of epidemic outbreaks on supply chains: Mapping a research agenda amid the COVID-19 pandemic. *Annals of Operations Research*, *319*, 1159–1196. https://doi.org/10.1007/s10479-020-03685-7

Shamsuddin, S. M. (2016). Asset Integrity Management (AIM) in chemical process industry. *Journal of Advanced Research in Materials Science*, *24*(1), 1–11.

Siswanto, N., & Salim, A. (2019). *Manajemen Proyek*. CV Pilar Nusantara.

Whitten, J. L., & Bentley, L. D. (2007). *Systems Analysis and Design Methods*. McGraw-Hill Education.