Mabny : Journal of Sharia Management and Business
Vol. 06, No. 01 (2026), 47-59
Department of Sharia Management and Business,
Faculty of Economics and Islamic Business, Universitas Islam Negeri Madura

Critical Path Method and Gantt Chart-Based Truck Fleet Scheduling at PT. Bangun Jaya Sentosa

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Article History
Received : 2026-07-08
Revised : 2026-07-15
Accepted : 2026-07-23
Published : 2026-07-23

Keywords:
Scheduling, Critical Path Method, Gantt Chart, Fleet Management, Service Quality

DOI:
https://doi.org/10.19105/mabny.v6i1.25625

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Cite this article:
Shofi, F., & Permana, D. A. (2025). Critical Path Method and Gantt Chart-based truck fleet scheduling at PT. Bangun Jaya Sentosa. Mabny : Journal of Sharia Management and Business, 6(1), 47-59
https://doi.org/10.19105/mabny.v6i1.25625

Abstract

Purpose – This study aims to analyze and redesign truck operational scheduling at PT. Bangun Jaya Sentosa Pamekasan using the Critical Path Method (CPM) and Gantt Chart to identify critical activities, determine schedule flexibility, and reduce operational delays.

Methodology – A descriptive quantitative case study approach was applied. Data were collected through process observation, interviews with the operational manager, scheduling staff, and drivers, and documentation of historical truck-rental records.

Findings – The CPM analysis identified ten core activities with a critical path of A-B-C-D-E-G-H-J and a minimum operational cycle duration of 4,180 time units. Activities F and I were non-critical, with slack values of 360 and 320 time units.

Implications – The findings extend scheduling theory by showing how criticality and slack can be interpreted jointly with fleet-management, queueing, and service-quality mechanisms in a demand-volatile local rental setting. Practically, the proposed schedule supports lower delay risk, reduced fleet idle time, more accurate truck-availability prediction, and stronger service reliability and responsiveness.

Originality – The study converts deterministic CPM and Gantt Chart outputs into operational decision rules for urgent-order prioritization, service recovery, and vehicle-availability control under breakdown, rental-extension, and nighttime-access constraints.

Introduction

Scheduling planning is a core operational activity that determines how limited resources are assigned to a sequence of interdependent tasks. In operations management, scheduling links resources, work priorities, start times, and completion times so that services can be delivered within the promised time and with minimum idle capacity (Heizer et al., 2019; Slack et al., 2022). Scheduling theory further emphasizes that job sequences, precedence relations, and completion-time targets are essential for optimizing system performance in service and production environments (Baker & Trietsch, 2018; Pinedo, 2022).

Infrastructure development and goods distribution increase demand for transportation services, including truck and heavy-equipment rental. Field observations at PT. Bangun Jaya Sentosa indicate that construction-material delivery, project logistics, and short-notice orders create fluctuating demand that must be matched with a limited number of vehicles and drivers. The

P ISSN 2797-8487 | E ISSN 2797-6319

resulting service capacity is perishable: an unused truck-hour cannot be stored, while one late return can immediately disrupt the next customer order (Heizer et al., 2019; Slack et al., 2022).

Comparable operational problems have been documented in other transportation settings. A coal-hauling case in South Kalimantan found that weak trip control, uncontrolled stopping time, and limited real-time monitoring lengthened the operating cycle; a fleet-management scenario supported a potential 35% reduction in cycle duration (Putri & Martini, 2022). Research on parcel-delivery services also shows that delivery timeliness and service quality influence customer decisions and satisfaction, confirming that schedule reliability is a customer-facing performance attribute rather than an internal administrative issue (Nantigiri et al., 2021; Pinem et al., 2024).

PT. Bangun Jaya Sentosa is a truck and heavy-equipment rental company that supports large-scale customer delivery projects in Pamekasan Regency. Truck rental is one of its main services, so the company must synchronize vehicles, drivers, fuel preparation, loading activities, travel windows, unloading, inspection, and truck return. The company was selected purposively because its operations represent a local service-retail setting characterized by direct customer contact, short order cycles, fluctuating demand, limited capacity, and immediate customer evaluation of punctuality and truck availability.

The main operational problem is the frequent arrival of urgent truck-rental orders that must be prioritized ahead of previously scheduled jobs. These requests disturb the planned truck departure-and-return sequence and can shift delays to other customers. Vehicle breakdowns after use, customer requests to extend rental periods, and urban operating-hour restrictions that allow trucks to pass only between 18:00 and 06:00 further increase schedule uncertainty. CPM and Gantt Chart were selected because the observed problem concerns activity dependence, cycle duration, bottlenecks, and schedule flexibility. CPM identifies activities that directly determine total completion time and calculates allowable slack, while the Gantt Chart converts those calculations into a timeline that operational staff can monitor (Kerzner, 2022; Project Management Institute, 2021). Profitability and liquidity were not specified as research variables because the immediate research problem is operational schedule reliability; possible financial effects are treated as downstream managerial implications rather than tested outcomes.

Precise scheduling is particularly relevant to truck-rental services because vehicles, drivers, loading windows, road access, and return slots must be available at the same time. One late activity can create a cascading delay across departure, loading, unloading, return to the pool, and the next customer schedule. Fleet-management research confirms that vehicle monitoring, trip control, and maintenance information improve operational efficiency and resource readiness (Ibrahim et al., 2022; Putri & Martini, 2022; Sitorus et al., 2024).

Recent CPM studies demonstrate the method's ability to identify critical activities and improve time control in construction, maintenance, and repair projects (Aulia & Cipta, 2023; Dwiretnani et al., 2023; Hanifa et al., 2024; Rosita et al., 2024). Their dominant focus on project-based construction leaves a contextual gap in recurring local truck-rental operations, where the same fleet is repeatedly reassigned, urgent orders compete with existing commitments, field conditions change, and city-level access restrictions affect departure and return timing. The study's originality lies in three linked contributions. First, it applies CPM and Gantt Chart to a recurring service cycle rather than a one-off construction project. Second, it interprets positive slack as operational buffer capacity for urgent-order rescheduling and service recovery, not merely as a mathematical residual. Third, it integrates scheduling theory with fleet management, queueing logic, and SERVQUAL to explain how technical schedule control can strengthen reliability and responsiveness.

The novelty is reinforced by the match between the factual problem and the empirical result. Urgent orders, breakdowns, rental extensions, and nighttime-access restrictions create the need for protected critical activities and flexible non-critical activities; the analysis subsequently identifies a critical sequence and two activities with usable slack. This linkage enables the study to move beyond reporting a critical path and formulate decision rules for prioritization, truck-availability prediction, and daily fleet control. The study aims to analyze the sequence of truck operational activities, calculate earliest and latest start and finish times, identify critical and non-critical activities, and prepare a Gantt Chart schedule for PT. Bangun Jaya Sentosa. Its practical contribution is a structured basis for daily or weekly fleet scheduling. Its theoretical contribution is an extension of network scheduling into a local service-retail environment in which slack also functions as a queue-management and service-recovery resource.

Literature Review

Operations Management

Operations management refers to the planning, coordination, and continuous improvement of processes that transform inputs into goods or services. In service operations, managers must balance resource availability, processing time, cost, quality, and delivery promises to create value for customers (Heizer et al., 2019; Slack et al., 2022). In PT. Bangun Jaya Sentosa's truck-rental context, operations management appears in fleet allocation, driver assignment, maintenance preparation, route coordination, and control of promised service time.

A strong operations system seeks to reduce waste, stabilize workflows, and use limited capacity effectively. Truck scheduling is therefore not merely an administrative list but a capacity-allocation mechanism that determines how vehicles, drivers, loading windows, and return slots are matched with customer orders (Heizer et al., 2019; Slack et al., 2022). Poor scheduling can make available fleet assets unproductive, whereas structured scheduling can reduce idle time and improve service dependability.

Scheduling Theory

Scheduling is the allocation of limited resources to jobs over time to satisfy performance objectives such as minimizing makespan, reducing tardiness, increasing resource utilization, and maintaining due-date reliability (Baker & Trietsch, 2018; Pinedo, 2022). Scheduling decisions include determining task order, activity start and finish times, resource priorities, and the handling of jobs that compete for the same resources.

Baker and Trietsch (2018) explain that scheduling theory provides analytical tools for sequencing jobs in various environments, including single-machine, flow-shop, job-shop, and service systems. Pinedo (2022) adds that scheduling models can be deterministic or stochastic depending on the certainty of processing times and operational constraints. In the PT. Bangun Jaya Sentosa case, scheduling theory is used to organize truck departure and return sequences, allocate priority for urgent orders, and coordinate truck availability under operating-hour limitations.

Scheduling theory also highlights the role of precedence relationships among activities. A truck cannot travel to the loading location before inspection, fuel preparation, and vehicle checks are completed, and the return trip cannot be started before unloading and final inspection are completed. These logical dependencies make a network-based model more appropriate than a simple list because each delay can be traced to its effect on the total service cycle (Kerzner, 2022; Project Management Institute, 2021).

Fleet Management

Fleet management refers to the planning, monitoring, maintenance, and performance evaluation of vehicles used to deliver operational services. It covers vehicle readiness, driver assignment, fuel use, safety control, maintenance schedules, availability records, and cost management (Hazrathosseini et al., 2023; Sitorus et al., 2024). In truck-rental services, fleet management determines whether company capacity can be converted into timely service.

Scheduling is a central element of fleet management because it specifies when a vehicle is in use, under inspection, under maintenance, or available for the next order. A well-structured schedule reduces idle time, increases utilization, and decreases the risk of operational delay. Fleet management systems in hauling operations have been shown to improve productivity and reduce empty stop time by enabling more systematic monitoring of fleet activities (Sitorus et al., 2024).

Effective fleet management is not determined only by the number of trucks owned by a company. Trucks that are technically available can still create service problems when they are not scheduled according to precedence relations, loading requirements, road restrictions, and return timing. CPM and Gantt Chart help fleet managers distinguish activities that must be protected from delay and activities that can absorb operational disturbances through slack.

Indonesian fleet-management evidence strengthens this argument. Putri and Martini (2022) show that real-time trip information and activity control can shorten a coal-hauling cycle, while Ibrahim et al. (2022) demonstrate that an ERP-based fleet-management system can integrate vehicle records and operational monitoring in a transportation service provider. These findings indicate that a scheduling model becomes more useful when its planned times are connected to actual vehicle status and trip data.

Queueing Theory

Queueing theory explains how waiting lines form when service demand exceeds service capacity at a given time. Queueing systems are characterized by arrival patterns, service-time distribution, number of service channels, system capacity, and service discipline such as first-come-first-served or priority rules (Gross et al., 2008). Truck-rental orders can be viewed as customer arrivals, while trucks and drivers represent service facilities.

When rental requests increase while fleet capacity remains limited, customer waiting time and order backlogs become unavoidable. Scheduling that considers queueing logic helps the company evaluate the consequences of prioritizing urgent orders, rejecting requests, extending rental periods, or delaying non-critical tasks. This perspective supports a more transparent operational policy because customers are affected not only by vehicle availability but also by the fairness and clarity of scheduling decisions (Gross et al., 2008; Pinedo, 2022).

Service Quality

Service quality reflects the extent to which delivered service meets or exceeds customer expectations. The SERVQUAL model identifies five dimensions: tangibles, reliability, responsiveness, assurance, and empathy (Parasuraman et al., 1988). Later service-marketing literature continues to treat reliability and responsiveness as important dimensions because customers judge service providers by their ability to fulfill promises and respond quickly to problems (Zeithaml et al., 2018).

Reliability in truck rental is closely linked to the company's ability to deliver and return trucks according to schedule. Responsiveness appears in the ability to handle urgent orders, vehicle damage, customer extensions, and operating-hour restrictions without causing uncontrolled delays. Empirical service-quality studies also show that reliability and responsiveness shape customer satisfaction and loyalty when customers experience direct service performance (Sinollah & Masruroh, 2019).

Studies in Indonesian delivery services provide a similar customer perspective. Delivery timeliness contributes to service-use decisions, while service quality affects satisfaction in goods-delivery operations (Nantigiri et al., 2021; Pinem et al., 2024). For a truck-rental company, these findings imply that schedule adherence is not only an efficiency measure but also a mechanism through which customers experience reliability and responsiveness.

Critical Path Method (CPM)

CPM is a network scheduling technique used to plan, schedule, and control a set of interdependent activities. Each activity is assigned a duration and linked to predecessor and successor activities, then analyzed through forward pass and backward pass calculations to obtain earliest start (ES), earliest finish (EF), latest start (LS), and latest finish (LF) values (Kerzner, 2022; Project Management Institute, 2021).

The critical path is the longest sequence of dependent activities with zero slack, and it determines the minimum total duration of the operational cycle. Any delay in a critical activity directly increases the total completion time, whereas non-critical activities with positive slack can be shifted within their allowable limits. Recent CPM studies show that the method helps identify priority activities, reduce inefficiencies, and provide a more objective basis for project-time control (Hanifa et al., 2024; Kim, 2020; Ridwan, 2025).

Recent Sinta-indexed studies confirm that CPM-based network analysis is effective for exposing activities that control completion time. Aulia and Cipta (2023) use CPM-PERT network planning to optimize project time and cost, while Dwiretnani et al. (2023) identify critical work packages and a 240-day completion duration in a building project. The present study retains the same precedence-based logic but transfers it to a repetitive truck-rental service cycle.

Theoretical Linkage in This Study

Operations management provides the broad framework for how PT. Bangun Jaya Sentosa transforms vehicles, drivers, fuel, information, and time into truck-rental services. Scheduling theory supplies the analytical basis for ordering activities and controlling processing time. Fleet management explains the use of trucks as critical resources, while queueing theory clarifies why limited vehicle capacity creates waiting time when demand increases.

SERVQUAL connects the technical schedule to customer-perceived quality. CPM and Gantt Chart can improve reliability by clarifying activities that cannot be late and improve responsiveness by showing which non-critical activities still have slack. The integration of these theories supports the study's argument that truck scheduling is both an operational-control issue and a service-quality strategy.

The integrated framework treats the CPM critical path as the protected core of the service process, positive slack as limited recovery capacity, fleet-management information as the monitoring mechanism, and service quality as the customer-level outcome. Route and transportation-cost analysis remains complementary because route design determines where a truck travels, whereas CPM clarifies when dependent operational activities must occur (Pramudita, 2020).

Research Methods

This research was designed as a case study of PT. Bangun Jaya Sentosa, a truck and heavy-equipment rental company in Pamekasan Regency. A descriptive quantitative approach was applied because the study quantified operational activity durations, precedence relationships, and schedule parameters using CPM and Gantt Chart. Case study design is appropriate when the researcher examines an operational process in its real-life organizational context (Yin, 2018). Data were collected through observation, interviews, and documentation. Observation covered the truck-rental workflow from order receipt to truck return to the pool. Interviews were conducted with operational managers, scheduling staff, and drivers to identify activity sequences, average durations, urgent-order problems, rental-period extensions, vehicle breakdowns, and operating-hour restrictions. Documentation used historical truck-rental records, departure and arrival schedules, delay reports, and fleet maintenance notes (Creswell & Creswell, 2018; Yin, 2018).

The object of analysis consisted of operational activities involved in one truck-rental cycle. Each activity was identified according to activity name, activity code, predecessor relationship, and duration in time units (t). These data were arranged as a work breakdown structure and converted into a network model for CPM analysis. The analysis followed four stages. First, the activity network was constructed based on precedence relations. Second, a forward pass was used to calculate ES and EF, while a backward pass was used to calculate LS and LF. Third, slack was calculated to determine critical and non-critical activities. Fourth, a Gantt Chart was prepared to visualize activity timing, critical-path activities, non-critical activities, and schedule flexibility (Kerzner, 2022; Project Management Institute, 2021).

The time unit (t) followed the operational unit recorded by the company, so the analysis emphasized the relative comparison among activities and their effect on total cycle duration. Initial validation was conducted by reconfirming activity order, predecessors, and average durations with operational personnel. This validation was needed to ensure that the network model represented the actual truck-rental workflow rather than an abstract mathematical model detached from field conditions.

Results and Discussion

Findings

The CPM and Gantt Chart calculations were used to compare the existing scheduling condition with a proposed structured schedule, identify activities that contribute most strongly to operational delays, and formulate scheduling improvements for PT. Bangun Jaya Sentosa. The analysis focused on reducing total cycle uncertainty, minimizing fleet idle time, and strengthening the reliability of truck availability for subsequent customer orders.

Table 1. Work Breakdown Structure and Relationships among Truck Operational Activities at PT. Bangun Jaya Sentosa

No.	Activity Name	Code	Duration (t)	Predecessor
1	Initial truck condition inspection	A	320	-
2	Truck system and equipment checking	B	280	A
3	Fuel and lubricant refilling	C	420	B
4	Travel from PT. Bangun Jaya Sentosa pool to loading site	D	700	C
5	Loading equipment/goods onto the truck	E	520	D
6	Rechecking the truck after loading	F	160	D
7	Travel from loading site to unloading site	G	740	E, F
8	Unloading equipment/goods at destination	H	500	G
9	Final truck condition inspection at destination	I	180	G
10	Return trip from destination to PT. Bangun Jaya Sentosa pool	J	700	H, I

Source: Processed operational data, 2026.

Table 1 presents the main activities in PT. Bangun Jaya Sentosa's truck-rental operation, starting from the initial truck inspection and ending when the truck returns to the pool and becomes available for the next order. Each activity is assigned a code from A to J, a duration in time units (t), and a predecessor relationship that shows the logical order of execution. This information became the basis for constructing the activity network and calculating the schedule using CPM.

Table 2. ES, EF, LS, and LF Calculation Results Using CPM

No.	Activity	Duration (t)	ES	EF	LS	LF
1	A	320	0	320	0	320
2	B	280	320	600	320	600
3	C	420	600	1020	600	1020
4	D	700	1020	1720	1020	1720
5	E	520	1720	2240	1720	2240
6	F	160	1720	1880	2080	2240
7	G	740	2240	2980	2240	2980
8	H	500	2980	3480	2980	3480

No.	Activity	Duration (t)	ES	EF	LS	LF
9	I	180	2980	3160	3300	3480
10	J	700	3480	4180	3480	4180

Source: Processed CPM calculation, 2026.

Table 2 shows the earliest start (ES), earliest finish (EF), latest start (LS), and latest finish (LF) values for each activity. ES and EF values were obtained through the forward pass, while LS and LF values were obtained through the backward pass. The total duration of the truck operational activity network at PT. Bangun Jaya Sentosa is 4,180 time units, as shown by the EF and LF values of the final activity (J).

Table 3. Critical Path and Activity Slack Values

No.	Activity	Duration	ES	EF	LS	LF	Slack	Status
1	A	320	0	320	0	320	0	Critical path
2	B	280	320	600	320	600	0	Critical path
3	C	420	600	1020	600	1020	0	Critical path
4	D	700	1020	1720	1020	1720	0	Critical path
5	E	520	1720	2240	1720	2240	0	Critical path
6	F	160	1720	1880	2080	2240	360	Non-critical
7	G	740	2240	2980	2240	2980	0	Critical path
8	H	500	2980	3480	2980	3480	0	Critical path
9	I	180	2980	3160	3300	3480	320	Non-critical
10	J	700	3480	4180	3480	4180	0	Critical path

Source: Processed CPM calculation, 2026.

Table 3 shows the slack value for each activity. Activities with zero slack are categorized as critical and form the critical path A-B-C-D-E-G-H-J with a total duration of 4,180 time units. Activities F and I have slack values of 360 and 320 time units, respectively, so they can be shifted within certain limits without affecting the total completion time.

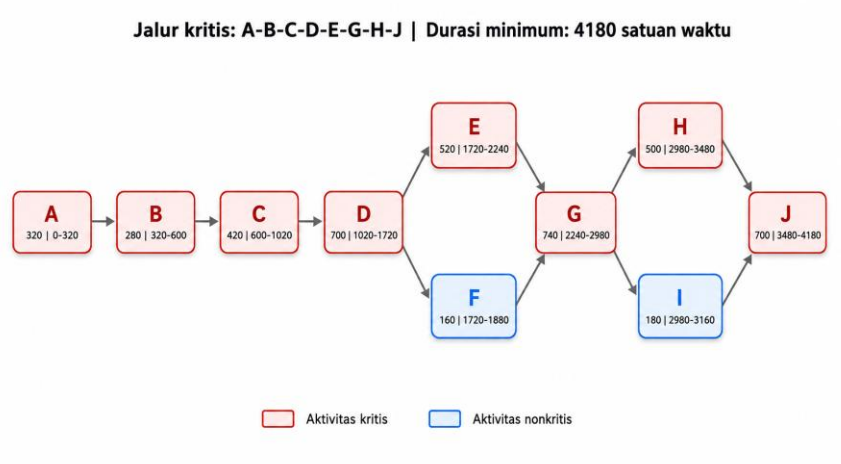

Figure 1. Truck Operational Network Diagram at PT. Bangun Jaya Sentosa with Critical Path Markers

Source: Processed network analysis, 2026.

Figure 1 illustrates the truck operational network at PT. Bangun Jaya Sentosa by presenting activity codes, durations, start-finish times, and critical-path markers. Activities A, B, C, D, E, G, H, and J are on the critical path, while activities F and I are non-critical activities with positive slack.

This diagram enables management to identify activities that must be controlled strictly and activities that can be shifted without extending the total duration.

Table 4. Gantt Chart Scheduling of Truck Operations at PT. Bangun Jaya Sentosa in Start-Finish Form

Code	Activity Name	ES	EF	Duration (t)
A	Initial truck condition inspection	0	320	320
B	Truck system and equipment checking	320	600	280
C	Fuel and lubricant refilling	600	1020	420
D	Travel from PT. Bangun Jaya Sentosa pool to loading site	1020	1720	700
E	Loading equipment/goods onto the truck	1720	2240	520
F	Rechecking the truck after loading	1720	1880	160
G	Travel from loading site to unloading site	2240	2980	740
H	Unloading equipment/goods at destination	2980	3480	500
I	Final truck condition inspection at destination	2980	3160	180
J	Return trip from destination to PT. Bangun Jaya Sentosa pool	3480	4180	700

Note: ES = earliest start; EF = earliest finish. The time unit (t) follows the company's operational data unit.

Source: Processed Gantt Chart schedule, 2026.

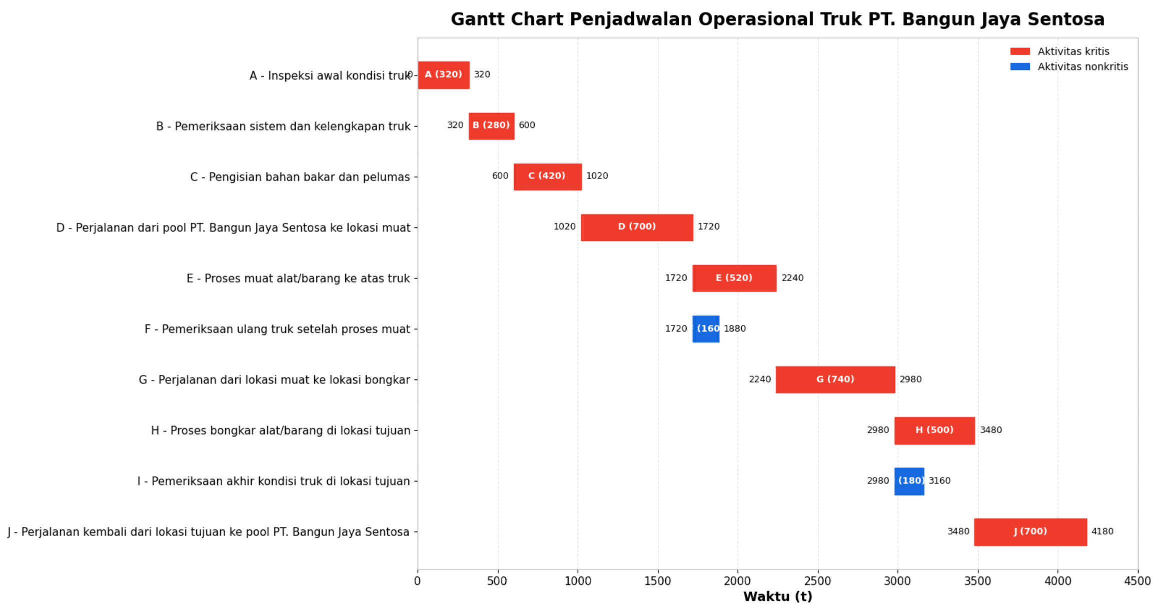

Figure 2. Gantt Chart of Truck Operational Scheduling at PT. Bangun Jaya Sentosa

Source: Processed Gantt Chart visualization, 2026.

The Gantt Chart of PT. Bangun Jaya Sentosa's truck operational scheduling visualizes the implementation of ten main activities in one operational cycle. The horizontal axis shows the time scale from 0 to 4,180 time units, while the vertical axis lists activities A to J. Activities A, B, C, D, E, G, H, and J form the critical path, whereas activities F and I run in parallel as non-critical activities with time flexibility.

Discussion

The CPM analysis identifies A-B-C-D-E-G-H-J as the protected sequence that determines the minimum operational cycle. The substantive meaning is not the sequence label itself, but the absence of recovery time along that chain. A delay in inspection, preparation, loading, travel, unloading, or return is transmitted directly to truck availability for the next order, which supports scheduling theory's emphasis on precedence relationships and due-date control (Baker & Trietsch, 2018; Pinedo, 2022). The critical status of these activities is explained by their structural position and duration. Activities A, B, and C are mandatory readiness gates; D connects the prepared vehicle to the loading point; E is the longer branch before activity G; H is the longer branch before the return activity; and J closes the cycle before the truck can be reassigned. Their zero-slack condition therefore reflects both logical dependence and the dominance of the longer parallel branches, consistent with network-planning principles (Kerzner, 2022; Project Management Institute, 2021).

Activities F and I are non-critical because each runs in parallel with a longer activity. The recheck after loading finishes earlier than loading activity E, and the final inspection at destination finishes earlier than unloading activity H. Their positive slack does not mean that they are unimportant or statistically non-significant; it means that limited timing adjustments can be absorbed before the controlling successor activity is delayed. Since this study uses deterministic CPM rather than inferential hypothesis testing, the appropriate distinction is critical versus non-critical activity, not significant versus non-significant coefficient. The result is consistent with project studies in which CPM exposes work packages that must be protected from delay (Aulia & Cipta, 2023; Dwiretnani et al., 2023; Hanifa et al., 2024; Ridwan, 2025). The present finding extends that evidence because the network represents a recurring rental-service cycle rather than a one-time construction project. Repetition changes the managerial consequence: one delayed cycle not only affects the current job but can also reduce the reliability of subsequent bookings.

The Gantt Chart adds managerial value by translating network calculations into visible start-finish commitments. Operational staff can compare planned and actual times, identify the point at which a deviation threatens the critical path, and communicate a revised truck-availability estimate before customer dissatisfaction escalates. This function addresses a weakness of experience-based scheduling, which often records bookings without explicitly displaying dependency, overlap, or remaining flexibility (Slack et al., 2022).

The fleet-management interpretation is supported by Indonesian transportation evidence. Putri and Martini (2022) show that trip monitoring and control can materially shorten a coal-hauling cycle, while Ibrahim et al. (2022) and Sitorus et al. (2024) demonstrate the value of integrated fleet information for vehicle monitoring and productivity. CPM-Gantt scheduling provides the planned time structure; GPS, ERP, maintenance records, and dispatch logs provide the actual data needed to keep that structure current. Queueing logic explains how the company should respond to urgent orders. An urgent request should not automatically interrupt an activity already on the protected chain because the interruption would transfer delay to the current customer and the next booking. Management should first use available slack, assign another ready truck, or negotiate a transparent service window. Priority rules are therefore constrained by service capacity and by the need to preserve fairness among customers (Gross et al., 2008; Pinedo, 2022).

Service-quality theory clarifies the customer consequence of schedule control. Reliability is created when the company fulfills the promised truck-availability and delivery time, while responsiveness is created when staff can provide early information and a feasible alternative during breakdowns, extensions, or urgent requests. Evidence from Indonesian delivery services similarly links timeliness and service quality with customer decisions and satisfaction (Nantigiri et al., 2021; Pinem et al., 2024; Sinollah & Masruroh, 2019).

The theoretical contribution lies in interpreting slack as more than unused time. In a local truck-rental service, slack functions as bounded service-recovery capacity that can absorb a disturbance, support queue reprioritization, and protect customer-facing reliability. This interpretation connects CPM's deterministic time structure with fleet-management visibility, queueing discipline, and SERVQUAL outcomes, thereby extending scheduling theory into a demand-volatile service-retail setting. The practical contribution is a control architecture that can be implemented without immediately purchasing additional trucks. PT. Bangun Jaya Sentosa can establish standard target times for critical activities, designate a responsible person for each stage, display a daily Gantt board, record actual start-finish times, and create escalation triggers when a critical activity exceeds tolerance. Non-critical slack should be treated as a controlled reserve rather than routinely consumed.

Route optimization and schedule control should be developed as complementary tools. Route analysis can reduce distance and transportation cost, while CPM protects the timing of dependent activities before, during, and after the trip (Pramudita, 2020; Ait Mamoun et al., 2024). A digital dispatch system can later integrate route, maintenance, driver, order-priority, and critical-path information so that management decisions are based on the same operational data. The findings remain bounded by the deterministic durations recorded in the case company. Weather, traffic, road closures, breakdown severity, customer extensions, and variation among drivers were not modeled probabilistically. Future research should combine CPM with PERT, simulation, vehicle-routing scenarios, and real-time GPS data, then evaluate whether schedule improvements produce downstream changes in operating cost, profitability, liquidity, customer satisfaction, and repeat-order behavior.

Conclusion

Truck operational scheduling at PT. Bangun Jaya Sentosa using CPM and Gantt Chart identifies a protected critical path of A-B-C-D-E-G-H-J with a minimum operational cycle of 4,180 time units. Activities F and I provide limited flexibility through slack of 360 and 320 time units. The result answers the operational problem by distinguishing activities that must not be delayed from activities that can absorb controlled adjustments. The theoretical implication is that CPM slack can be interpreted as bounded service-recovery and queue-management capacity in a recurring rental-service cycle. The practical implication is that management can improve reliability and responsiveness by protecting critical activities, using non-critical slack selectively, and communicating truck availability from a visible schedule rather than from informal estimates.

PT. Bangun Jaya Sentosa is recommended to use CPM and Gantt Chart as routine planning and evaluation tools, establish standard times and escalation rules for critical activities, integrate schedules with vehicle-maintenance and dispatch records, and compare planned versus actual completion times after every cycle. Future studies should incorporate PERT, simulation, route optimization, real-time fleet data, and financial indicators to test the effects of schedule improvement on operating cost, profitability, liquidity, customer satisfaction, and repeat orders.

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Writing – original draft: Fadhoilus Shofi, Diyan Agus Permana
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