



# Operational Bottlenecks in Freight Forwarding: An Empirical Investigation into Their Impact on Reducing Cargo Turnaround Time

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## ABSTRACT

International freight forwarding has long served as the operational foundation underpinning global commerce. Despite this critical role, systemic inefficiencies continue to compromise service delivery and cargo transit timelines. This study examines the principal operational constraints embedded within freight forwarding workflows and empirically measures their cumulative effect on cargo turnaround duration, with the targeted objective of identifying evidence-grounded strategies capable of delivering a sustained 5% reduction in processing time. Using a descriptive-analytical research design, primary data were gathered from 120 professionals, logistics students, and industry stakeholders through a structured Likert-scale survey instrument. The dataset was subjected to descriptive statistics, Pearson correlation, multiple regression, and one-way ANOVA. Results indicate that technology integration ( $\beta = 0.576$ ,  $p = 0.003$ ) is the strongest positive driver of logistics performance, while unresolved bottleneck accumulation ( $\beta = -0.404$ ,  $p = 0.007$ ) materially degrades operational outcomes. Among all variables examined, cargo handling efficiency showed the highest correlation with overall performance ( $r = 0.642$ ,  $p < 0.001$ ). Documentation inaccuracies, customs processing delays, terminal congestion, and insufficient shipment visibility were collectively identified as the most operationally costly delay clusters. The study concludes that structured elimination of these constraints — through accelerated digital adoption, dual-layer documentation controls, appointment-based port scheduling, and proactive compliance management — can realistically achieve the stated turnaround objective. These outcomes carry meaningful implications for logistics practitioners, supply chain policymakers, and academic researchers.

**Keywords:** *Freight Forwarding, Operational Bottlenecks, Cargo Turnaround Time, Logistics Performance, Supply Chain Efficiency, Digital Documentation, Port Congestion, Technology Adoption*

## 1. INTRODUCTION

The cross-border movement of goods represents one of the most operationally intricate endeavours in contemporary commerce. Freight forwarding — broadly understood as the coordination of multi-modal cargo transit across carrier networks, regulatory jurisdictions, and documentation frameworks — sits at the centre of this complex ecosystem. In a trade environment characterised by shrinking delivery windows, escalating customer service expectations, and accelerating liberalisation, the operational capacity of freight forwarding organisations has become a decisive factor in shaping competitive positioning and supply chain resilience.

Unlike asset-based carriers, freight forwarders assume a coordinating role: they plan, direct, and supervise cargo movement from point of origin to final destination, interfacing with ocean carriers, airlines, port terminals, customs administrations, warehouse facilities, and surface transport providers. This multi-party operating model introduces numerous potential delay points at each interface — each of which compounds into elevated cargo dwell times, mounting transactional costs, and declining service reliability. Recurrent delay sources include documentation inaccuracies, lagging customs clearance processes, terminal congestion, underinvestment in digital infrastructure, and fragmented inter-agency communication.

## 2. NEED FOR THE STUDY

The intensification of global trade volumes, combined with growing supply chain complexity, has placed mounting operational pressure on freight forwarding functions. Despite considerable advances in logistics technology, a significant share of transit delays continues to arise from avoidable operational failures — incorrectly prepared documentation, slow customs resolution, inadequate scheduling discipline, and the underutilisation of available digital tools. The financial and reputational costs of such failures fall heavily on both service providers and their commercial clients.

A critical gap remains in the empirical research landscape: few studies have quantitatively mapped the direct relationship between specific operational bottlenecks and measurable performance outcomes at the firm level, particularly within developing and emerging trade contexts. Much existing scholarly

work addresses supply chain disruption at a macroeconomic scale; granular firm-level analysis of how discrete delay factors influence turnaround time remains comparatively limited.

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### 3. SCOPE OF THE STUDY

The study's scope is defined across thematic, methodological, and operational dimensions. Thematically, it encompasses the full freight forwarding cycle — from cargo booking and document preparation through customs processing, terminal operations, international transit, and final delivery. Ten categories of operational constraints form the analytical focus: documentation delays, customs clearance lags, port congestion, transport scheduling failures, inter-stakeholder communication gaps, manual process dependency, cargo handling inefficiencies, regulatory compliance shortfalls, warehouse congestion, and the absence of real-time shipment visibility.

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### 4. OBJECTIVES OF THE STUDY

The study is guided by the following key objectives:

- To identify and categorise the dominant operational constraints encountered in freight forwarding workflows.
- To assess the measurable impact of these constraints on cargo turnaround time and overall logistics performance.
- To analyse the relationship between technology adoption, documentation accuracy, and operational performance outcomes.
- To determine the extent to which demographic and occupational factors shape perceptions of logistics performance quality.
- To formulate targeted, evidence-based recommendations for achieving a sustainable 5% reduction in cargo turnaround duration.

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### 5. REVIEW OF LITERATURE

#### 5.1 Operational Bottlenecks and Logistics Performance: Foundational Perspectives

The academic examination of operational bottlenecks in logistics has accumulated considerable depth over the past two decades. Early foundational scholarship drew attention to two recurring structural causes of logistics delay: inadequate information flow across organisational boundaries and insufficient coordination between supply chain partners. These insights shaped a broader understanding that effective logistics management is less a function of isolated task execution than of systemic process coherence and inter-organisational alignment. From this perspective, the challenge of delay reduction is fundamentally one of system design rather than individual operational correction.

#### 5.2 Customs Clearance, Documentation Challenges, and Trade Facilitation

Customs clearance inefficiencies and documentation shortcomings have consistently emerged as the most economically disruptive constraints in cross-border freight operations. Periodic assessments of global logistics performance have repeatedly identified customs processing quality as one of the most underperforming dimensions across trade corridors — particularly across South and South-East Asian markets where procedural fragmentation and manual processing dependencies remain prevalent. These findings have remained consistent across multiple reporting cycles, underscoring the structural and persistent nature of the problem rather than its cyclical or crisis-driven character.

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### 6. RESEARCH METHODOLOGY

#### 6.1 Research Design

The study employs a descriptive and analytical research design, suited to systematically mapping the nature, prevalence, and operational consequences of freight forwarding bottlenecks. The methodology is primarily quantitative, grounded in structured survey data. This approach enables the collection of contextually anchored, practitioner-relevant data in a format amenable to robust statistical testing.

#### 6.2 Population and Sample

The target population comprises individuals with direct or indirect exposure to freight forwarding and logistics operations. A convenience sampling approach was applied, yielding a final usable sample of  $N = 120$  respondents. The sample included students ( $n = 64$ ), logistics employees ( $n = 50$ ), business professionals ( $n = 3$ ), and others ( $n = 3$ ), distributed across three age cohorts: below 20 years ( $n = 46$ ), 21-30 years ( $n = 54$ ), and 31-40 years ( $n = 20$ ).

### 6.3 Data Collection Instrument

A structured questionnaire was developed in two sections. Section A captured five demographic variables: age group, gender, educational qualification, occupation, and work experience. Section B contained 15 Likert-scale statements (Q6-Q20), measuring five operational constructs: Operational Efficiency (Q6, Q8, Q9), Delay Factors (Q7, Q10, Q11), Regulatory and Compliance Factors (Q12, Q14), Technology Adoption (Q13, Q15, Q18, Q19), and Bottleneck Impact on Performance (Q16, Q17). The dependent variable, Overall Logistics Performance (Q20), was measured on a five-point scale from 1 (Strongly Disagree) to 5 (Strongly Agree).

### 6.4 Statistical Tools and Analytical Framework

Data analysis employed the following statistical methods:

- Descriptive Statistics: Frequency distributions, mean scores, and standard deviations for all Likert-scale variables.
- Pearson Correlation Analysis: To examine linear relationships between key operational variables and overall logistics performance.
- Multiple Regression Analysis: To identify statistically significant predictors of overall logistics performance, using Q20 as the dependent variable.
- One-Way ANOVA: To test for significant differences in performance perception across age and occupational groups.

## 7. ANALYSIS AND INTERPRETATION

### 7.1 Descriptive Statistics

Across all 15 Likert-scale items, mean scores ranged from 3.533 (Real-time Tracking, Q15) to 4.325 (Digital Documentation Systems, Q13), with every variable recording a mean above the neutral midpoint of 3.0 — indicating consistent respondent agreement across all measured constructs. Key variable statistics are presented in Table 1.

**Table 1: Descriptive Statistics of Key Likert-Scale Variables (N = 120)**

Variable	N	Mean	Std. Dev.	Interpretation	Status
Digital Documentation Systems	120	4.325	0.963	Agree	Highest
Cargo Handling Efficiency	120	4.258	0.865	Agree	Strong
Port Congestion Impact	120	4.242	0.944	Agree	Strong
Transportation Scheduling	120	4.242	0.898	Agree	Strong
Documentation Errors	120	4.142	1.048	Agree	Moderate
Customs Clearance Time	120	4.133	0.995	Agree	Moderate
Regulatory Compliance	120	4.133	1.012	Agree	Moderate
Automation Reduces Delays	120	4.117	1.055	Agree	Moderate
Overall Logistics Performance	120	4.225	1.000	Agree	High
Real-Time Tracking Systems	120	3.533	1.495	Agree	Varied

Source: Primary Survey Data

Digital Documentation Systems recorded the highest mean ( $M = 4.325$ ,  $SD = 0.963$ ), followed by Cargo Handling Efficiency ( $M = 4.258$ ,  $SD = 0.865$ ) and Port Congestion Impact ( $M = 4.242$ ,  $SD = 0.944$ ), signalling strong respondent consensus on their criticality. Variables associated with real-time tracking ( $SD = 1.495$ ) and technology adoption ( $SD = 1.380$ ) exhibited markedly higher variability, reflecting uneven uptake patterns and divergent perceptions of technological readiness across the sample population.

### 7.2 Pearson Correlation Analysis

The Pearson correlation matrix surfaces several statistically significant inter-variable associations. Cargo Handling Efficiency (Q8) demonstrated the strongest positive relationship with Overall Logistics Performance ( $r = 0.642$ ,  $p < 0.001$ ), followed by Port Congestion Impact ( $r = 0.628$ ), Transportation Scheduling and Digital Documentation (both  $r = 0.613$ ), Regulatory Compliance ( $r = 0.585$ ), and Automation ( $r = 0.554$ ) — each statistically significant at  $p < 0.001$ . These associations confirm that logistics performance is a multidimensional construct shaped by the coordinated interplay of physical handling quality, procedural discipline, and digital enablement.

### 7.3 Multiple Regression Analysis

The regression model achieved overall statistical significance [ $F(4, 115) = 25.641$ ,  $p < 0.001$ ], accounting for 47.1% of variance in Overall Logistics Performance ( $R^2 = 0.471$ , Adjusted  $R^2 = 0.453$ ) — a substantial explanatory fit for a survey-based logistics study. Regression coefficients are presented in Table 2.

**Table 2: Multiple Regression Coefficients (Dependent Variable: Overall Logistics Performance)**

Predictor Construct	Beta ( $\beta$ )	t-value	p-value	Significance
Technology Adoption (Q13, Q15, Q18, Q19)	0.576	3.059	0.003	**
Delay Factors (Q7, Q10, Q11)	0.422	4.313	< 0.001	***
Bottleneck Impact (Q14, Q16, Q17)	-0.404	-2.735	0.007	**
Operational Efficiency (Q6, Q8, Q9)	0.221	1.616	0.109	ns

Note: \*\*\*  $p < 0.001$ ; \*\*  $p < 0.01$ ; ns = not significant.  $N = 120$ .

Technology Adoption ( $\beta = 0.576$ ,  $t = 3.059$ ,  $p = 0.003$ ) emerged as the most powerful positive predictor, confirming that investments in digital documentation, real-time monitoring, and process automation produce the highest performance returns. Delay Factors ( $\beta = 0.422$ ,  $t = 4.313$ ,  $p < 0.001$ ) constituted the most statistically reliable predictor cluster — indicating that targeted reduction of documentation errors and customs processing lags delivers consistent and reproducible performance improvements across varied operational conditions. Bottleneck Impact ( $\beta = -0.404$ ,  $p = 0.007$ ) recorded a significant negative coefficient, empirically confirming that unaddressed port congestion and supply chain inefficiencies actively suppress logistics performance rather than simply limiting it. Operational Efficiency ( $\beta = 0.221$ ,  $p = 0.109$ ) failed to achieve statistical significance in isolation, suggesting its effects are mediated through technology adoption and bottleneck management pathways.

### 7.4 One-Way ANOVA

Age group ANOVA revealed statistically significant differences in performance perception [ $F(2, 117) = 10.356$ ,  $p = 0.0001$ ]. Respondents in the 31-40 cohort ( $M = 4.900$ ,  $SD = 0.447$ ) rated overall logistics performance substantially higher than those in the 21-30 bracket ( $M = 4.333$ ) and those below 20 years ( $M = 3.804$ ,  $SD = 1.067$ ), indicating that professional maturity meaningfully deepens appreciation of logistics performance requirements. The null hypothesis of equal group means was rejected.

Occupation-based ANOVA produced an equally significant result [ $F(3, 116) = 15.438$ ,  $p < 0.001$ ]. Employees recorded the highest mean performance perception ( $M = 4.840$ ,  $SD = 0.510$ ), substantially exceeding that of students ( $M = 3.781$ ,  $SD = 1.046$ ). This 1.06-point differential confirms that direct industry exposure sharpens sensitivity to both bottleneck severity and operational performance benchmarks — with clear implications for logistics workforce development and academic curriculum design.

## 8. FINDINGS

The following key findings emerge from the empirical analysis:

- Technology adoption constitutes the strongest and most consistent driver of logistics performance improvement. Digital documentation systems ( $M = 4.325$ ) recorded the highest mean across all variables, while the regression coefficient ( $\beta = 0.576$ ) confirms that digital transformation delivers the most impactful route to achieving the targeted cargo turnaround reduction.
- Operational bottlenecks actively and measurably suppress logistics performance rather than merely constraining it. Bottleneck impact was the only construct to yield a significant negative regression coefficient ( $\beta = -0.404$ ,  $p = 0.007$ ), confirming that terminal congestion and supply chain inefficiencies represent quantifiable performance deficits with direct consequences for turnaround duration.

- Cargo handling efficiency is the variable most strongly correlated with overall logistics performance ( $r = 0.642$ ,  $p < 0.001$ ), indicating that ground-level cargo management processes are foundational to operational outcomes — surpassing technology adoption and scheduling in bivariate predictive strength.
- Delay factors — encompassing documentation errors, customs clearance processing, and regulatory compliance — form the most statistically reliable predictor cluster ( $\beta = 0.422$ ,  $t = 4.313$ ,  $p < 0.001$ ), meaning that targeted interventions in these areas generate the most consistent and replicable performance improvements across diverse operational environments.

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## 9. CONCLUSION

This study on operational bottlenecks in freight forwarding and their measurable impact on cargo turnaround time yields a coherent, empirically grounded set of conclusions with direct practical relevance for the logistics industry. The evidence consistently establishes that documentation processing failures, customs clearance inefficiency, terminal congestion, insufficient digital integration, and fragmented inter-stakeholder communication constitute the primary structural barriers to optimal turnaround performance. Multiple regression analysis confirms that technology adoption represents the most powerful performance lever available to freight operators, while unresolved bottleneck accumulation measurably destroys operational efficiency rather than simply limiting it.

The ANOVA findings introduce an important educational dimension to this analysis: the severity of operational bottlenecks is substantially underestimated by individuals without direct industry exposure, pointing to an urgent need for practice-oriented, experiential learning within logistics education programmes and closer institutional linkages between academic bodies and freight sector practitioners.

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